



FOR TO GOV. USE, CLIENT

**OPERATOR, ORGANIZATIONAL  
DIRECT AND GENERAL SUPPORT  
AND DEPOT MAINTENANCE MANUAL**

**BREAKER, PAVING: DUAL PURPOSE  
SINKER DRILL AND PAVING BREAKER  
GED**

**(ATLAS COPCO IND. COBRA MODEL BBM 47L)**

**FSN 3820-902-3107**

This copy is a reprint which includes current  
pages from Change 1.

**Operator, Organizational, Direct and General Support  
and Depot Maintenance Manual  
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GED  
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TM 5-3820-240-15, 9 November 1967, is changed as follows:

Page 3. After Note and before HOW TO OPERATE, add the following:

**MAINTENANCE AND OPERATING SUPPLIES.** Refer to table 1 for a complete list  
tenance and operating supplies required for initial operation of the breaker.

*Table 1. Maintenance and Operating Supplies*

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F/initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
FUEL TANK	9130-160-1818	Gasoline, Bulk, Regular Grade, MIL-G-3056			(1) See C9100-II for additional data positioning proced
FUEL TANK	9150-265-9433	Oil, Lubricating, MIL-L-2104, OE-30, 1 qt. can	1 qt		(2) Mix 1 part lub- ing oil to 20 parts gasoline.
ROTATION JOINT	9150-257-5361	Grease, Aircraft, MIL-G-7711 GB, 1 lb can	1 lb		(3) Grease rotation at least once a w

Page A-1. Appendix A, Basic Issue Items List, is  
superseded as follows:

**APPENDIX A  
BASIC ISSUE ITEM LIST AND ITEMS  
TROOP INSTALLED OR AUTHORIZED  
Section I. INTRODUCTION**

**A-1. Scope**

This appendix lists basic issue items, items troop  
installed or authorized which accompany the  
breaker and are required by the crew/operator for  
operation, installation, or operator's main-  
tenance.

**A-2. General**

This basic issue items, items troop in  
authorized list is divided into the fol-  
lows:

a. Basic Issue Items List — Section  
plicable.

### A-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

*a. Source, Maintenance, and Recoverability Code(s) (SMR):* Not applicable.

*b. Federal Stock Number.* This column indicates the Federal stock number assigned to the

Federal item name and any additional designation of the item required.

*d. Unit of Measure (U/M).* A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

*e. Quantity Authorized (Items Troop Installed or Authorized Only).* This column indicates the quantity of the item authorized to be used in the equipment.

(1) Mfr code	(2) Federal stock number	(3) Description Usable on code	(4) Unit of meas	(5) Qty furn with equip	(6) Fig No
		Hose, Exhaust (14388) 92100707 Puck Frame (14388) 92100724 Box Transport (14388) 92100700 Wedge (14388) 92000114 Drill Steel (14388) 7140434 Padlock (14388) 92100526 Oil Measure (14388) 92010148 Tool Roll Assy, Consist of the following: Screwdriver (14388) 9027519 Screwdriver (14388) 9027618 Pliers, Flat (14388) 92010372 Pliers, Flat (14388) 9030102 Wrench, Spanner (14388) 9020408 Wrench, O/E (14388) 9020415 Wrench, O/E (14388) 9020417 Wrench, O/E (14388) 9021032 Wrench, O/E (14388) 9021037 Wrench, Socket (14388) 92010388 Wrench, Socket (14388) 92010389 File, Point (14388) 92010324 Gauge, Feeler (14388) 92010325 Gauge, Angle (14388) 92010147 Template (14388) 7951327 Holden wheel (14388) 16000294 Gauge, Chuck (14388) 30910038			

Official:

*General, United States Army  
Chief of Staff*

VERNE L. BOWERS

*Major General, United States Army*

*The Adjutant General*

Distribution:

To be distributed in accordance with DA Form 12-25B, (qty req block No. 450) Organizational maintenance requirements  
Rock Drilling Equipment.

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OPERATOR AND ORGANIZATIONAL  
MAINTENANCE INSTRUCTIONS

Page

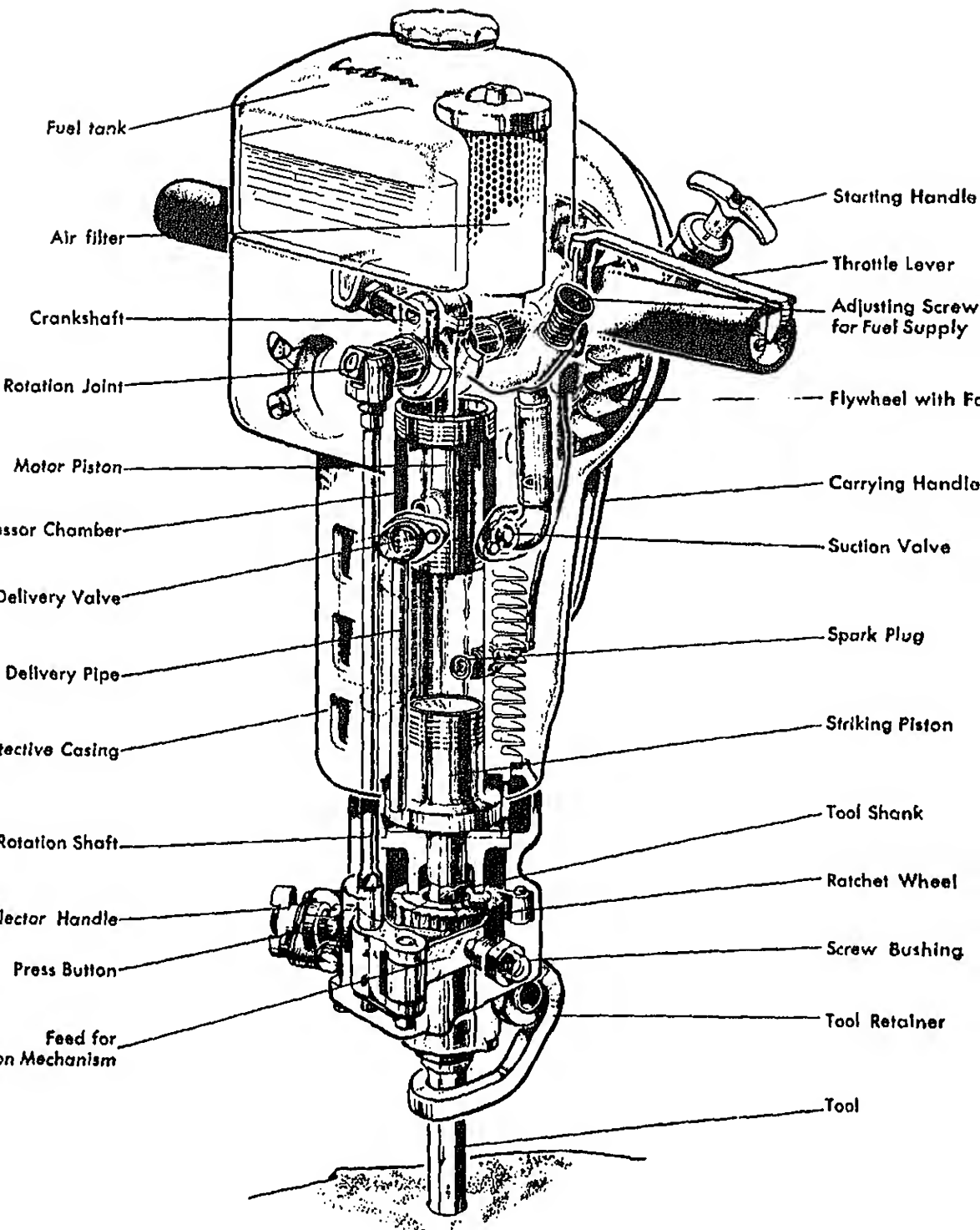
Main Parts	3
Design Features	4
Principal Data	4
How the Machine Operates	4
How to Operate	5
Exhaust Hose	6
Lubrication	6
Fuel	7
Care and Maintenance	7
Stoppages	10
Grinding of Drill Steels	12
Drill Steel Grinder BSM42	13

When Should the Machine be Overhauled	3
Repair Tools and Testing Equipment	4
Dismantling	4
Cleaning	11
Upper Section with Motor	11
Fuel System	16
Lower Section for BBM 47L -- dismantling	19
Starter	31
Flywheel Magneto and Spark Plug	32
Assembling	35
Test Run	36
Permissible Wear Limits	39
Recommended Tightening Torques	41

<b>APPENDIX A Basic Issue Items List</b>	<b>A-1</b>
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<b>B Maintenance Allocation Chart</b>	<b>B-1</b>
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## DESIGN FEATURES

### Motor and compressor

- The Motor is an air cooled, two-stroke petrol motor with loop scavenging system and 70 c.c. cylinder.
- The Fuel Tank is a light metal casting. The air intake for the tank is fitted with a replaceable filter.
- The Valve Type Carburettor allows drilling at any angle up to 45° from the horizontal. The screw for the fuel supply control is located on the carburettor.
- The Starter is housed in front of the flywheel and incorporates a pull wire with return spring.
- The Ignition System incorporates a flywheel magnet. The ignition coil and condenser are impregnated against moisture giving protection also under extreme tropical conditions. The breaker mechanism is wholly encased. The flywheel is fixed on the crankshaft by means of a key to ensure that the ignition timing cannot be changed, which is an advantage from the point of view of operation reliability.
- Compressor. The differential type motor piston has an annular compression space under the larger diameter of the motor piston.

### Striking mechanism and rotation

- The Striking Piston operates in the same cylinder bore as the motor piston. The striking piston moves freely in its bore and is fitted with particularly durable piston rings to withstand the heavy stresses involved.
- The Tool Chuck is fitted with a gasket which prevents air leakage between the tool chuck and tool shank and also dirt from entering the machine. For effective air flushing of the bore hole and correct air pressure under the striking piston this gasket is of vital importance.
- Rotation Mechanism. The rotation chuck is driven from the crankshaft via a torsion shaft. The reciprocating movement of the torsion bar is transmitted by means of a feed to the ratchet wheel of the tool chuck. The rotation mechanism thus operates independently of the striking piston.
- The Tool Retainer is simple and robust in design. The tool is easily released.
- The exhaust pipe of the silencer can be revolved. This is an advantage when, for instance, working in a pit from which the exhaust gases have to be conducted up to ground level.

## PRINCIPAL DATA

Weight	25 kg (56 lb)
Overall length, incl. tool retainer	615 mm (24 in.)
Fuel consumption with 29 mm (1 1/8") bit	0.14—0.17 litres per meter 100—80 ft/Imp. gallon
Capacity of fuel tank	1.5 litres (1 1/8 Imp. gallon)
Mixture ratio of oil to gasoline	1: 20. For special oils, see page 6
Spark plug	Bosch W175T1 or K.L.G. F70
Electrode gaps	Contact breaker points 0.4 mm (0.016 in.) Spark plug 0.5 mm

## HOW THE MACHINE OPERATES

With the aid of the starter the crankshaft begins to rotate. When the motor piston moves downwards air is drawn, via the air filter, to the carburettor where it is mixed with fuel from the fuel tank. It then passes into the crankcase. When the piston moves upwards the fuel air mixture is compressed in the crankcase and transferred, via inlet ports, to the cylinder where it simultaneously expels the exhaust gases from the previous working cycle.

At the same time as the fuel air mixture is compressed in the crankcase, air is drawn into the compressor cylinder. When the motor piston moves downwards in the cylinder bore, the air in the compressor cylinder is compressed and conducted, via the delivery pipe, to the space under the striking piston.

This space is kept under overpressure by means of the

shank. At the same time the motor piston is forced upwards and when it reaches the limit of the stroke, a new working cycle begins.

When drilling, the compressed air is expelled through the drill steel, resulting in efficient flushing of the drill hole. When breaking, the air escapes to the atmosphere through an exhaust hole. The rotary movement of the drill steel is transmitted from the crankshaft, via the torsion shaft, to the crank piece and the feed which bring the tool chuck to rotate. The torsion shaft gives the drill steel a smooth rotation and reduces stresses should the drill steel seize in the hole.

It should be noted that during operation the rotation and/or the striking mechanism can be disengaged by means of the selector, without stopping the motor.

The switching to drilling or breaking is done by means of the selector on the lower part of the machine. The selector is furnished with a scale. The press button serves as an indicator.

Figure 1 indicates the position for drilling

Figure 2 indicates the idling position when drilling

Figure 3 indicates the idling position when breaking

Figure 4 indicates the breaking position

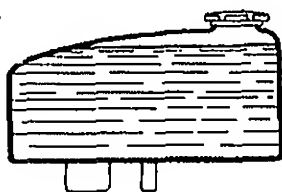
**Note.** In order to avoid unintentional switching the press button has to be pushed in when switching from position 2 (idling position drilling) to position 3 (idling position breaking) or the reverse. Should the selector not engage, turn the tool (tool chuck) a little so as to get the selector into the correct position.

## HOW TO OPERATE

### Before starting

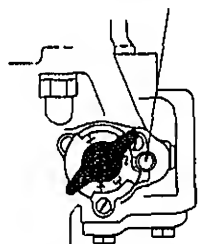
Before starting the machine always check:

that the fuel tank is filled correctly



Press button

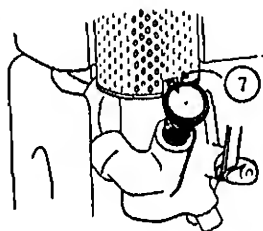
that the selector is in position 2 (idling position drilling) or position 3 (idling position breaking)



Idling

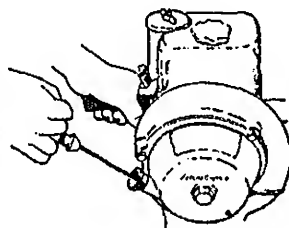
that the screw for adjusting the fuel supply is in its proper position. This screw is fitted with a scale. When starting, the screw should be turned to position 7. In cold weather it can be advantageous to turn the screw slightly past position 7.

When these checks are completed, the machine can be started.

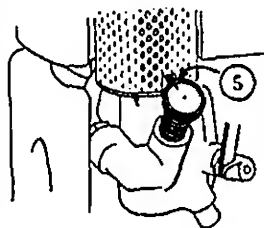


### Starting

Grasp the machine as shown in the illustration on the right and make sure that the starter engages. Start the motor by pulling out the starting wire rapidly and smoothly. To avoid an unnecessary heavy load on the starting spring do not pull out the wire completely.



When the machine has reached full working temperature, the fuel supply is reduced by setting the screw at position 5. The correct positioning of the scale can be checked by following the directions given on page 9.



**Note.** Always press in the button when switching the selector between idling positions 2 and 3.

## Drilling

From an economical point of view it is important not to use larger bit diameters than necessary.

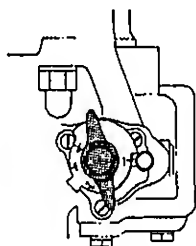
When collaring, first give the machine light throttle whilst guiding the drill steel with your foot until the steel has got a firm grip. Then apply full throttle.

During drilling, a relatively light feed pressure is required — just sufficient to prevent the machine from jumping on the drill steel collar. Guide the machine so that the drill steel rotates clear of edges of the hole. For horizontal drilling, grip the machine by the carrying handle with the right hand and engage the rotation with the left hand. Change grip and apply full throttle after the collaring. The machine can be used for drilling at any angle from vertical down to 45° upwards.

If the drill steel gets stuck in the bore hole assistant flushing is obtained by switching the selector to pos. 2 (idling pos. for drilling). When doing so, the stored compressed air in the lower part of the machine is forced through the drill steel.

During drilling, steel changes can be made without stopping the motor. Turn the selector to position 2 and lift the machine off the drill steel.

For drilling, the selector is turned to position 1 as shown in the illustration. When the selector handle is in this position the rotation and striking mechanism are engaged.

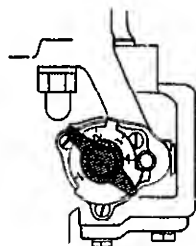


Drilling

## Breaking

When the machine is used as a breaker, the striking speed should be controlled by means of the throttle lever. The top type trigger affords a natural advantage during operation, as the machine develops its maximum speed when being depressed simultaneously with the trigger. When the machine is withdrawn again, the hand pressure on the upper part of the handle can be released so that the machine runs at lower speed.

For breaking, turn the selector to position 4. At this position only the striking mechanism is engaged.



Breaking

To stop the motor close the fuel screw. Stopping by shutting off the fuel supply prevents the motor from becoming choked and thus facilitates the next start. If the machine has been used for drilling it is suitable to turn the selector to position 2, thus disengaging the rotation and striking mechanism before stopping.

## EXHAUST HOSE

If used indoors, or in places where ventilation is poor, the machine should be fitted with exhaust hose.

## LUBRICATION

Due to the use of oil-mixed fuel, the majority of the moving parts of the machine are automatically lubricated. The mixture ratio should be 1 part of lubricating oil to 20 parts of petrol. An oil-can which is graded for the correct quantities of oil for 5 litres, 1 Imp. gal. and 1 U.S. gal. respectively of petrol is supplied with the machine. The fuel mixing should be done by shaking carefully in a separate clean container before filling the tank.

## Suitable grades of oil

The use of oil mixed fuel should not cause undue carbonization but ensure efficient lubrication, and give good protection against corrosion.

Use oil **MIL-L-2104**, Military Symbol **OE-30**, FSN 9150-265-9433.

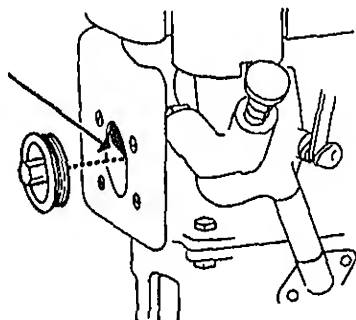
## Suitable grades of grease

A tube containing grease is supplied with the machine. This grease should be used in the first hand. Other suitable grade of grease is **MIL-G-2217**.

Grease should be applied at the two lubricating points indicated below.

### 1. The rotation joint

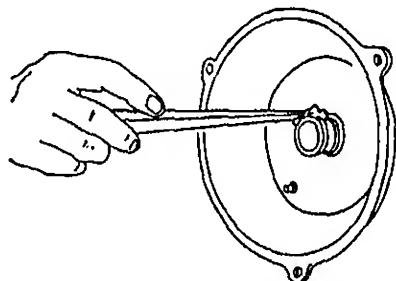
The rotation joint, which is located inside the cover of the protective casing, should be greased at least once a week.



Note that when fresh grease is replenished, not more than two-thirds of the space must be filled. If the space is completely filled, the grease may penetrate into the crankcase causing ignition trouble.

### 2. The bearing of the starting wheel

Fresh grease for the bearing of the starting wheel should be fed into the lubricating groove in the guide sleeve each time the machine is dismantled for overhaul.



## FUEL

The machine should be run on petrol mixed with oil. It is important that a good grade of petrol is used and that it is free from water and dirt. No advantage is gained by running on high-octane petrol. The mixing proportion is 1 part of motor oil to 20 parts of petrol.

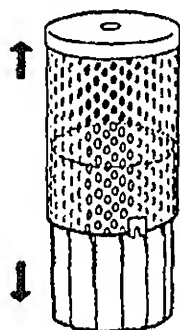
When required, the filter at the fuel tank air intake (below the tank filler cap) should be changed. Spare

## CARE AND MAINTENANCE

### Daily Servicing

The air filter, which is located on the carburettor, is of the dry filter type and consists of a woollen cloth sewn on to a wire screen. The filter is common to the motor and the compressor. Check daily that the air filter is clean. If necessary, it can be cleaned in petrol not mixed with oil. In order to allow the filter time to dry before the machine is started, it is best to clean it at the end of the working shift.

It is important to see that the textile covering of the filter is undamaged. A deformed filter casing should be straightened before the filter is inserted because a deformed casing may damage the filter. A damaged filter should be replaced immediately and it is, of course, advantageous always to have a spare filter at hand.

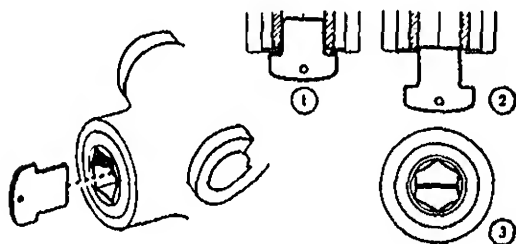


Note. Under dusty working conditions it may prove necessary to clean the filter more frequently than once a day.

### Overhaul

Overhauling should be carried out each time a tool chuck is replaced when this, according to the directions given below, is seen to be worn. In this connection, the machine is dismantled for cleaning, soot removing and replacement of any worn parts

The tool chuck should be checked with the gauge supplied with the machine. See illustration below. The gauge is placed between two flats of the hexagon. If



in this position (3), it goes in completely (1), the chuck should be renewed. If it enters partially or not

When the machine is warm and running normally, the scale on the screw for adjusting the fuel supply should be set at position 5.

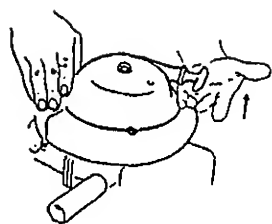
If the scale on the screw has become displaced, it can be reset at its original position. The following procedure should be followed:

1. Turn the selector to position 3 (idling position for breaking)
2. Start the machine and let it run until working temperature is reached
3. Run the motor at full speed
4. Slowly choke the fuel supply by means of the fuel adjusting screw until the motor runs intermittently
5. Then slowly increase the fuel supply — with the motor still running at full speed — until the motor runs regularly
6. Loosen the screw which retains the scale and turn the scale until the figure 5 is directly opposite the pointer

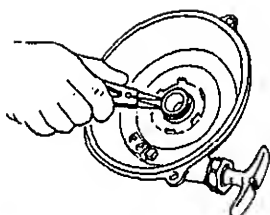
The machine is supplied in a special waterproof transport box. This box is the best place for storing the machine.

The transport box contains a tool bag with the necessary tools for current maintenance work.

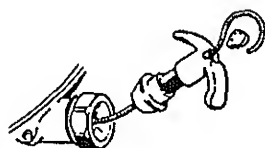
Remember that when the machine is dismantled or repaired it should be done by qualified mechanics.



1. Loosen the three screws which secure the starting casing to the crankcase. Detach the casing by giving it a few light taps with the hand.



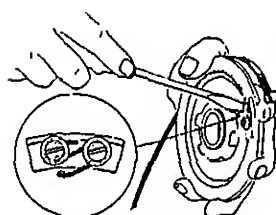
2. Remove the circlip from the guide sleeve with the special pliers supplied with the machine.



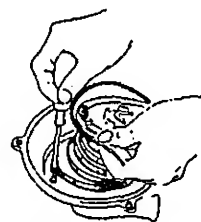
3. The handle is removed from the starting wire by loosening the wedge with pliers.



4. The starting wheel can then be lifted out of the casing and the worn wire replaced.



5. When attaching the new wire to the starting wheel care should be taken that it seats in its right position under the washers — as shown in the inset.



6. When assembling, the spring should be tightened one turn. It is also important that both the spring and the wire should be located in their correct positions. The spring is coiled clockwise and the wire anticlockwise.

## STOPPAGES

The Cobra motor-drill breaker is designed and manufactured with the view of obtaining a light, reliable and powerful machine. If the machine is not running satisfactorily, faults, as is usually the case with petrol motors, should first be sought for in the ignition or

fuel systems. In certain cases, stoppages can occur in the rotation mechanism or in the air flushing to the drill steel.

Directions are given below for the adjustments and minor repairs which may have to be carried out to remedy the above mentioned faults.

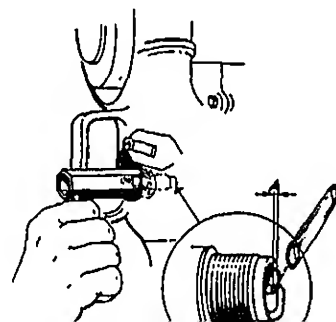
### Motor fails to start

1. Spark plug faulty. Remove the plug as shown in the illustration and check that it is free from defects.

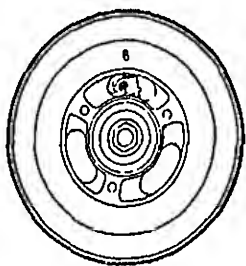
Clean off carbon or other deposits on the spark plug. Use care when cleaning the electrodes which can be polished with a fine emery cloth.

Check the gap A (see illustration) between the electrodes and, if necessary, adjust it to 0.5 mm (0.020 in.).

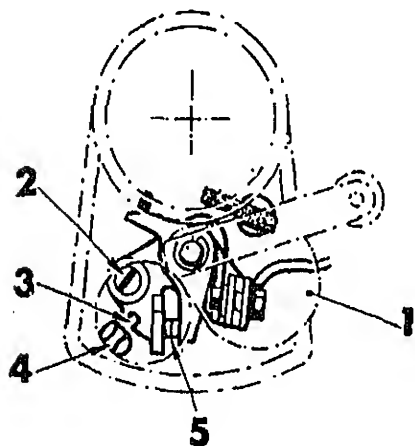
Also check the connection of the ignition cable to



2. Contact breaker points require adjustment. Dismantle the starting casing and the ratchet ring. Turn the flywheel so that the opening, marked B, is directly above the breaker points, as shown in the figure below. If, after lengthy service, the con-



tact breaker points in the magneto have become annealed, they should be polished with the file supplied with the machine. See that no filings or other particles are left between the contact surfaces after polishing. Check the gap between the breaker points by means of the 0.4 mm (0.016 in.) feeler gauge which is included in the tool bag. The breaker gap, which should be 0.4 mm (0.016 in.), is adjusted as follows:

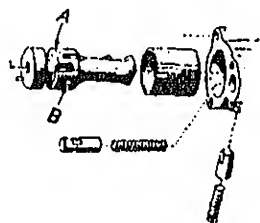


- a) Fold back the cover 1
- b) Slightly loosen the screw 2, which retains the contact breaker case
- c) With a screw driver inserted in the slot 3 in the contact breaker case and between the studs 4 on the stator disc, turn the contact breaker case clockwise or anti-clockwise so that the gap between the breaker points 5 is increased or decreased until a gap of 0.4 mm (0.016 in.) is obtained.
- d) Tighten the screw 2.

3. Motor has been choked with excess fuel. If the motor fails to start after repeated attempts, excess fuel may have entered the cylinder. Close the fuel screw and pull the starting handle a few times. When the correct fuel air mixture is achieved the motor will fire.

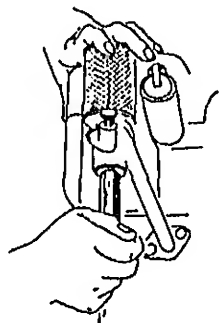
### Machine works intermittently or stops

1. The air passage in the drill steel is clogged. If the hole is completely choked the machine will stop when the striking and rotation mechanisms are engaged — if the hole is only partly choked, the machine will work intermittently. Therefore make sure that the air passage in the drill steel is always clear.

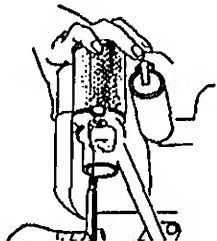


2. If, for some reason or other, the reducing holes A or B in the selector should be clogged, the machine will work intermittently or stop. Dismantle the selector and clean the holes.
3. Lack of fuel supply. At the point where the main fuel pipe connects to the carburettor there is a filter in the union. Check if this filter is clogged and requires cleaning.

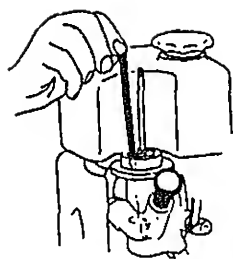
The fuel supply may also be interrupted by clogging of the four holes through which the fuel passes into the carburettor. Unscrew the cover of the carburettor and remove the valve.



If the fuel screw is opened and the machine kept vertical with an open tank cover, fuel should flow out of the four holes. If this is not the case clean the holes as shown in the illustration. Cleaning the







When the machine has not been used for a long time, the carburettor valve may dry up and stick to its seat. In this case, remove the air filter and depress the valve by means of a file, screw-driver or some other suitable tool.

## Poor rotation

1. **Ratchets worn.** When the ratchets in the lower section have been excessively worn, their grip is loosened in the ratchet wheel of the rotation chuck leading to a loss of rotation. Change the worn ratchets.
2. **Ratchet springs broken.** At the same time, also inspect the ratchet springs. If any of them are defective, they should be replaced.
3. **The sleeve of the screw bush operates sluggishly.** If the sleeve in the screw bush operates sluggishly the rotation is impaired. Dismantle the screw bush with sleeve and spring and clean the parts carefully.

Occasionally, a cold machine can have a tendency to over-rev with the result that the striking piston fails to make a complete strike and the drilling or breaking performance becomes less satisfactory. As a rule, this tendency disappears when the machine has attained normal working temperature. Do not press down the throttle lever completely until normal working temperature has been reached. If over-revving continues, this can be due to compressed air leakage. It is therefore expedient to check the following points in the order stated:

1. Check that the set-bolt nuts are sufficiently tightened (2 kpm-15 ft/lb)
2. Check the two valves of the compressor and the gaskets at the air intake pipe and the delivery pipe
3. Inspect the lower end of the delivery pipe for wear. Check the O-ring
4. Dismantle the lower section and check O-ring and gasket
5. Check if the selector has too much play in its bushing

## GRINDING OF DRILL STEELS

In order to obtain optimum working life of the drill steel it is important to regrind the tungsten carbide bit when the width of the cutting edge of the insert amounts to 2 mm (0.08 in.), measured 3 mm (0.12 in.) from the periphery of the insert, as shown in Fig. 1; the corner abrasion amounts to 7 mm (0.28 in.), measured from the highest point of the bit. Excessive corner abrasion — anti-taper — will subject the bit to wedge action against the walls of the hole.

Check the width of the cutting edge and the corner abrasion with the grinding template, 795 1327, supplied with the motor drill. Figs. 1 and 2 show the correct method of measuring. Do not grind down the tungsten-carbide bit too much — it should last for many regrindings.

The hot drill steel should be placed in a dry place — for instance, on the lid of the storage box — until it has cooled. Never place a hot steel in snow or water or on wet ground. The tungsten carbide may be damaged by rapid cooling.

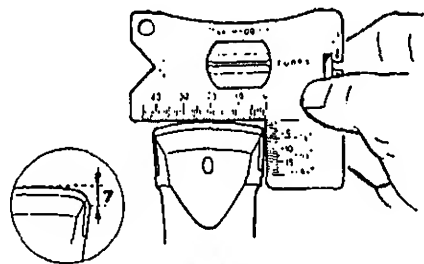
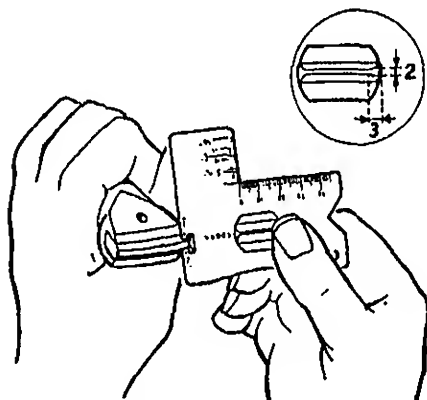


Fig. 2

The Grinder type BSM 42 is designed for use with the "Cobra" Motor-Drill. The grinding fixture always ensures that the drill bit has the proper edge angle and edge radius. Grinding is done along the bit. Therefore no incipient cracks can develop from scratches produced across the bit during grinding. Another important feature is the automatic dressing of the grinding wheel.

## DESCRIPTION

The grinder consists of

- Frame with rest and locking handle for the drill steel
- Removable spacer
- Support with grinding wheel
- Guard
- Spring loaded feed device
- Flexible drive for connection to the "Cobra" Motor-Drill

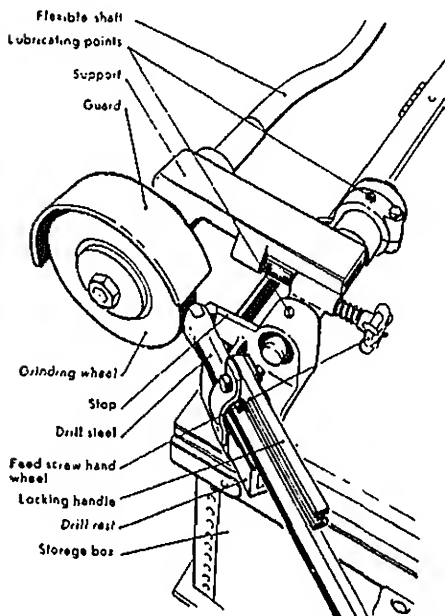


Fig. 1

## MOUNTING THE GRINDER

Screw the grinder on to the fixing plate on the lid of the "Cobra" storage box. Support the "Cobra" on a drill steel in a bore-hole. Remove the nut in the centre of the starter casing with the wrench (supplied with the grinder) and connect the flexible drive. A gentle pull of the starting handle will ensure that the square hole of the flexible drive locates the square head of the crankshaft. Ensure that the flexible drive is in alignment with the crankshaft and then tighten the connecting ring. (See Fig. 4, page 4).

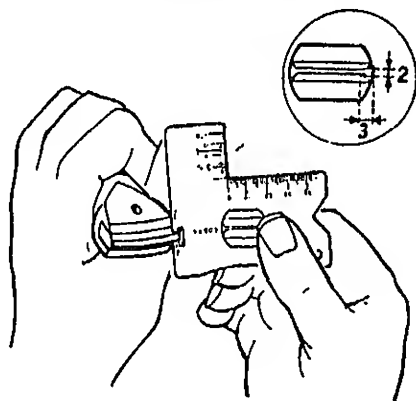


Fig. 2

Measuring edge width

## ADVICE FOR GRINDING

The bit requires regrinding when

- the edge width is 2 mm (0.08") measured 3 mm (0.12") from the outer edge. See Fig. 2.
- the corner abrasion is 7 mm (0.28") measured from the highest point of the bit. See Fig. 3.

Considerable corner abrasion — "reverse lead" or "lack of clearance" — produces a splitting action by exposing the bit to heavy lateral stresses.

Check edge width and corner abrasion with the template, 795 1327, supplied with the motor drill.

Figs. 2 and 3 show the correct method of measuring.

Never grind more off the bit than is necessary — this will ensure that it can then be reground many times.

After grinding, the steel will be hot and it should therefore be placed in a dry place — for instance, on the lid of the storage box — until it has cooled. Never place a hot steel in snow or water or on wet ground — since the hard metal insert may be damaged by rapid cooling.

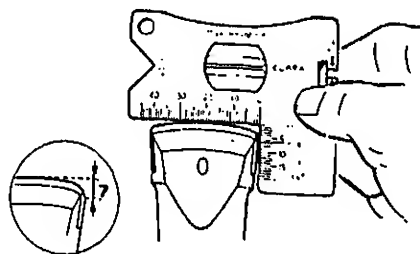


Fig. 3

Measuring the corner abrasion.

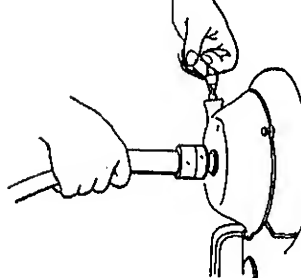


Fig. 4

A gentle pull at the starting handle will assist in engaging the flexible shaft of the grinder. Raise the flexible drive to a horizontal position before tightening the connecting ring.

## GRINDING

The grinder is delivered with spacer 9240 0183 mounted for use when grinding  $\frac{1}{8}$ " steels.

When grinding  $\frac{1}{8}$ " steels, the spacer must not be in the rest.

Raise the locking handle, place the drill steel in the rest against the stop and then lock the steel in position, by lowering the locking handle.

Turn the feed screw hand wheel so that the grinding wheel runs clear of the bit.

Place the idling lever of the "Cobra" in its vertical position, start up and then slip on the retaining ring for the throttle lever.

## Wear protective goggles!

Adjust the feed by means of the hand wheel with the left hand at the same time moving the support up and down with the right hand. When the grinding wheel is moved up and down it is automatically moved from side to side across the bit, thereby keeping the wheel face true and flat.

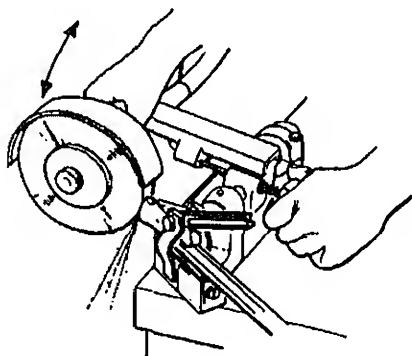


Fig. 5

Move the support up and down with the right hand over the bit while turning the hand wheel with the left hand to obtain a uniform feed pressure.

Never use excessive feed pressure. If the pressure is too great the grinding wheel can damage the end of the bit or stalling may occur, imposing excessive strain on the flexible driving shaft.

Before releasing the drill steel for any purpose, turn the hand wheel so that the grinding wheel is withdrawn and runs clear of the bit.

Always grind both sides of the bit uniformly — the edge should always be in the centre of the bit. Loosen and remove the drill steel. Check with the template that the corner dimension has been restored. Grind the circumference of the drill bit if necessary. See Fig. 6. Whet the edge of the bit to remove any sharpness and check that the edge width is between 0.3—0.4 mm. (0.0118 and 0.0157 in.)

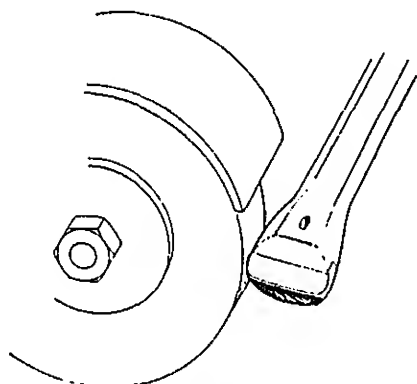


Fig. 6

To restore the corner dimension it is sometimes necessary to grind the circumference of the drill bit as shown.

## THE GRINDER SHOULD BE LUBRICATED

with oil at the two points shown in Fig. 1. In addition, the ball bearing at the drill connecting end of the flexible shaft should be inspected and greased at regular intervals. The bearings of the grinding spindle and the space between the flexible shaft and the outer casing should be filled with grease when the grinder is dismantled for overhaul.

## SUITABLE GRINDING WHEELS

with a 32 mm or a  $\frac{1}{8}$ " shaft hole are given in the spare parts list. The wheel can be easily replaced after loosening the nut with the box wrench 9240 0138, supplied with the grinder. NB! The nut has left-hand threads. When a new wheel has been fitted, it should be given a few minutes' trial run at maximum revolutions before being put into use.

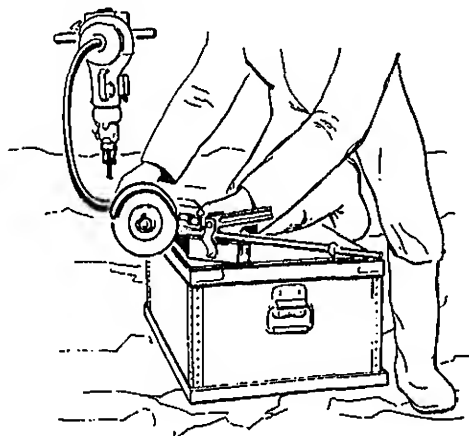


Fig. 7

Grinder BSM 42 at work.

## DIRECT AND GENERAL SUPPORT AND DEPOT MAINTENANCE INSTRUCTIONS

### When should the machine be overhauled?

In ordinary service the tool chuck is the part on motor-drills COBRA BBM 47L which is first worn out and therefore requires continuous supervision by way of regular checking of the wear.

Measure the chuck wear with the gauge supplied with the machine. See Fig. 1. Place the gauge between two flats of the hexagon (1). If it enters partially (2), the tool chuck can still be used. If it goes in completely (3), the chuck should be renewed. The motor-drill should be overhauled at the same time. Difficult working conditions and particularly neglect of the air filter may, however, have an adverse effect on the operating condition of the machine so that minor overhauling or major overhauling may be necessary before the tool chuck is worn out.

As a rule, minor overhauling implies, in the first hand, checking of the air filter,

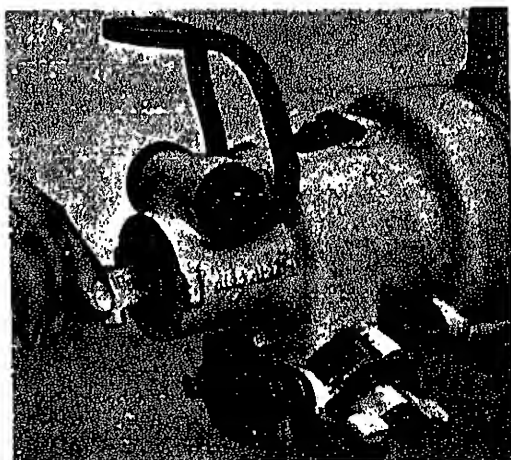
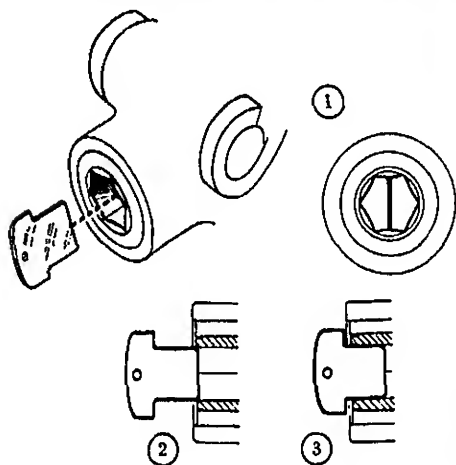
tool chuck, piston rings and relevant packings, and if necessary, renewal of these parts. A major overhaul comprises, in addition to these measures, all the other checkings and renewals described in this overhauling instruction.

Normally, two minor overhauls are carried out (the first and second minor overhaul) before the machine is considered to require a major overhaul. After a major overhaul, the machine can be regarded as equivalent to a new machine from a service point of view.

Under normal service conditions motor-breakers should be overhauled (major overhaul) after every 1500 hours operating time.

The major and minor overhauls should be carried out by a competent mechanic who is well familiar with the operation of the machine.

Fig. 1. The gauge is placed in the tool chuck between two flats of the hexagon (1). If it enters partially (2), the chuck can still be used. If it goes in completely (3), the chuck should be renewed.



## Repair tools and testing equipment

Tool box No. 9201 0402 contains the special tools and testing equipment for BBM 47. The tools are specified in a list (ASB-605) which will be found in the tool box. Other general tools are, as a rule, available in every engine shop.

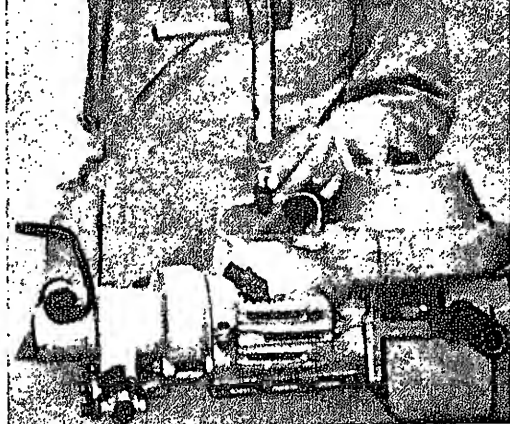


Fig. 2. Removing the spark plug



Fig. 3 Removal of the rubber grip is facilitated by entering a screw-driver between the rubber and the light metal and pouring in a few drops of oil.

## Dismantling

Clean the machine externally before dismantling.

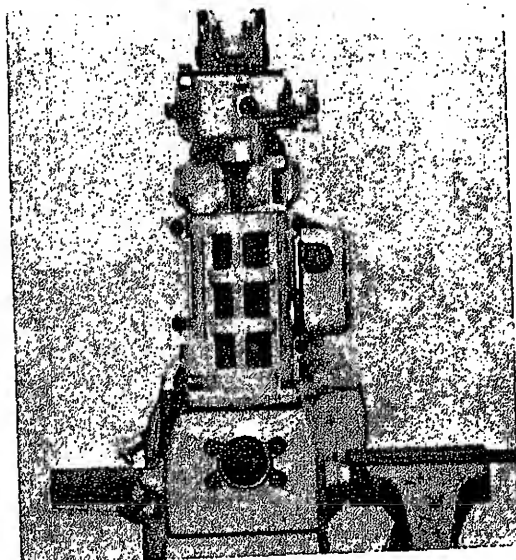
After this is done :

- Empty the fuel tank.
- Loosen the Ignition cable from the spark plug.
- Remove the spark plug ..... Fig. 2

**CAUTION** — If the lower section is dismantled, but the striking piston remains in the cylinder, Ignition of the residual fuel in the cylinder can take place, resulting in the striking piston being thrown out and causing damage.

- Remove one of the rubber grips. This is facilitated by pouring a few drops of oil between the rubber grip and the light-metal handle ..... Fig. 3
- Clamp the machine in tool 9201 0264 Fig. 4  
The machine can now be turned in

Fig. 4. The machine clamped in tool 9201 0264.



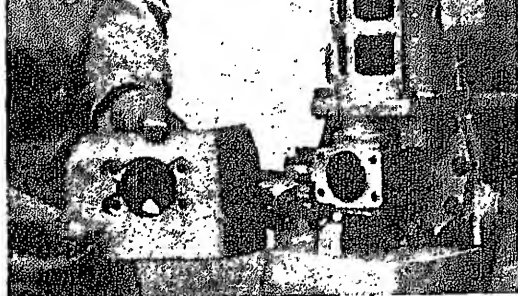


Fig. 5 The casing is removed by unscrewing the four retaining screws on the front of the casing

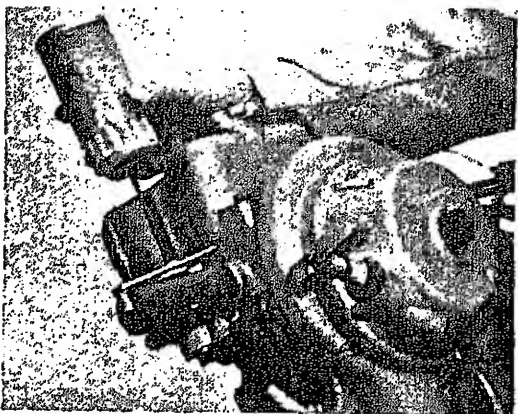
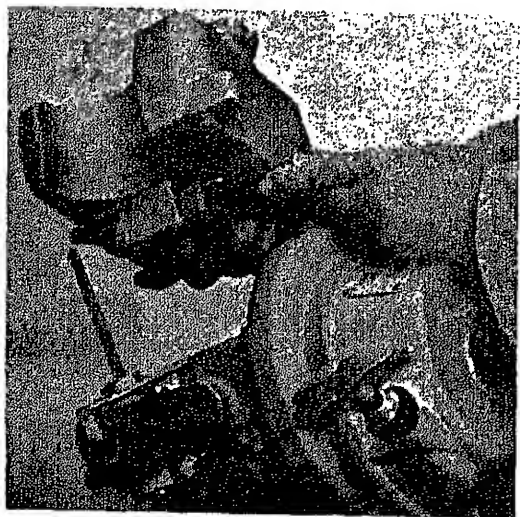


Fig. 6 The air filter and the filter casing can be removed by unscrewing the nut on top of the filter casing.

Fig. 7 After dismantling the three retaining screws, the fuel tank can be removed. Note — One of the retaining screws is fitted underneath the fuel tank



preferably in the following order:

- ① Casing ..... Fig. 5
- ② Air filter and fuel tank ..... Figs. 6—7
- ③ Starter casing 9210 0296 ..... Figs. 8—9

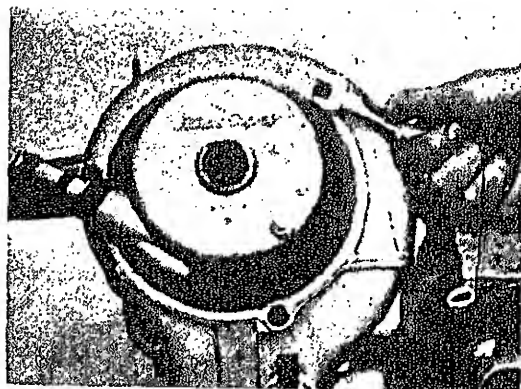
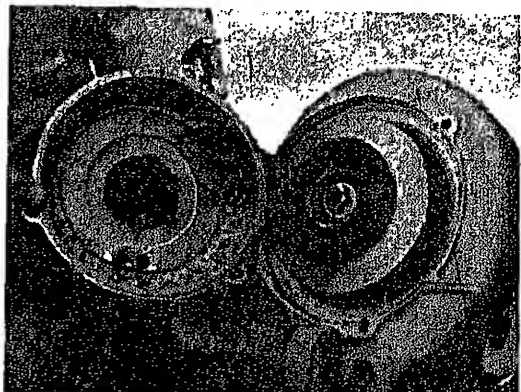


Fig. 8 Use a 12 mm spanner for removing the three retaining screws for the starter casing

Fig. 9 When the starter casing is removed, the start wheel, with attachment for the starting wire, becomes visible inside the casing



5. Flywheel — Use tool 9201 0194 ... Figs 11—12  
Remove key 338 3108 from the  
crankshaft.
6. Silencer ..... Fig. 13
7. Protective casing 9210 0122 ..... Fig. 14

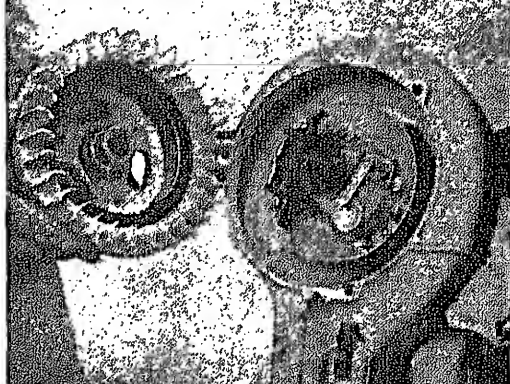


Fig. 12. When the flywheel is removed, the stator, with ignition coil and contact breaker, becomes visible

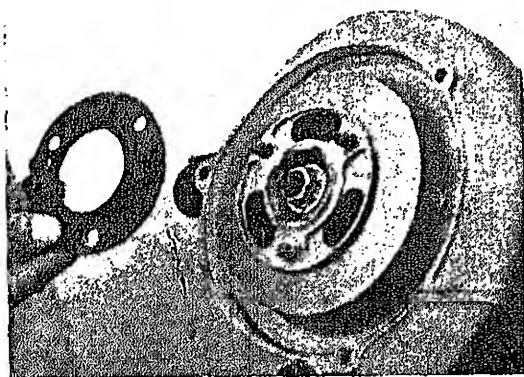


Fig. 10. Remove the retaining ring on the flywheel by unscrewing the three nuts

Fig. 11. By placing the tool 9201 0194 as shown in the figure, the flywheel can be removed by means of a socket wrench.

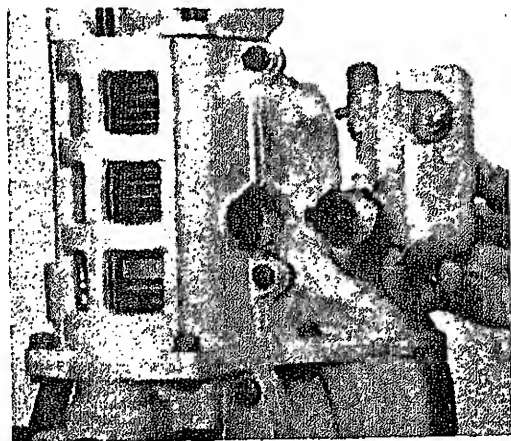
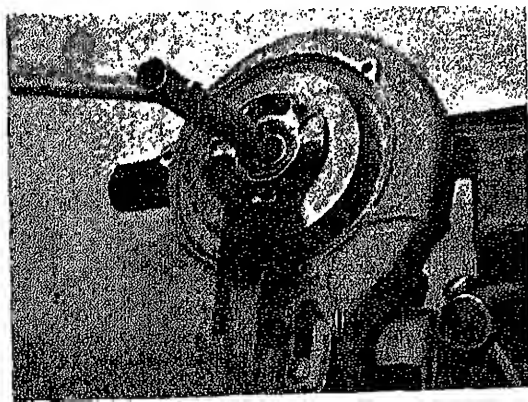
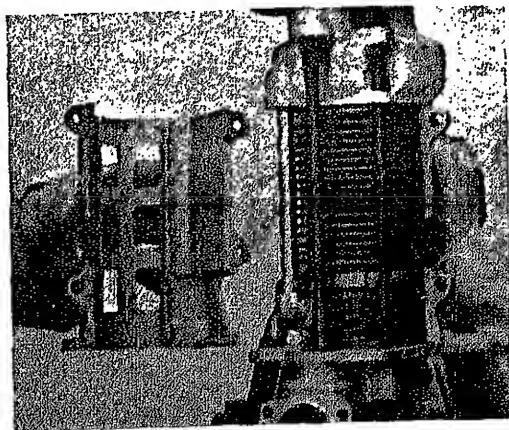


Fig. 13. Remove the silencer from the cylinder by unscrewing its two retaining screws

Fig. 14. The protective casing can be removed after unscrewing the six screws





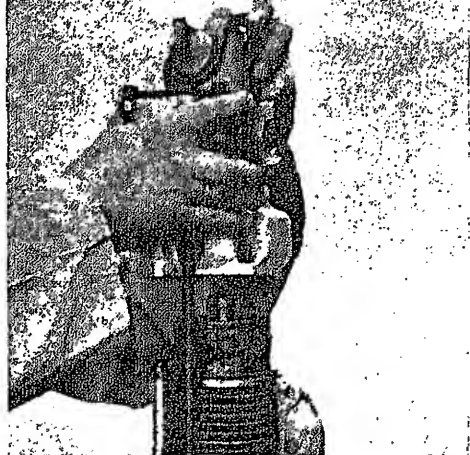


Fig. 15 The lower section is lifted carefully, after first having unscrewed the two nuts with set bolts.

Hold the tool chuck with the fingers so that it follows the lower section when lifted.

- ⑨ Intermediate part and striking piston Fig. 16
- ⑩ Delivery pipe 9210 0460 with spacer ring and delivery valve ..... Figs. 17—18
- ⑪ Suction hose 9210 0427 and suction pipe 9210 0454, also suction valve ..... Figs. 19—20—21

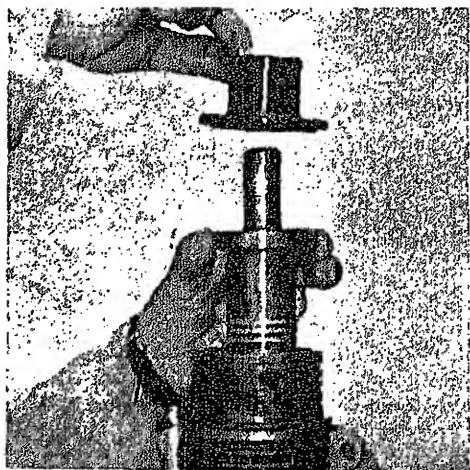


Fig. 16. Intermediate part and striking piston can now be removed.

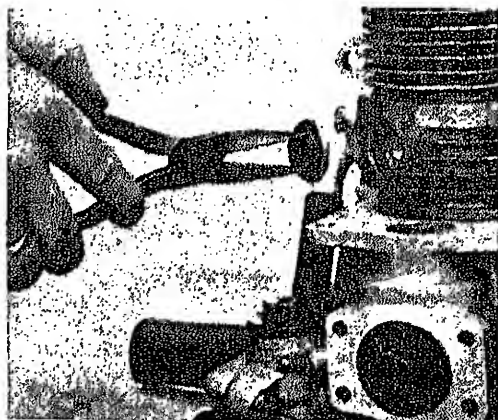


Fig. 18. Remove the delivery valve by means of flat pliers  
NOTE — The suction and delivery valves are identical but fitted differently. (See Fig. 21.)

Fig. 17. When the delivery pipe with spacer ring is removed, the delivery valve becomes visible.

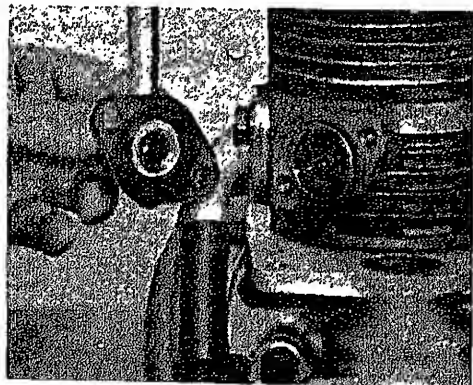
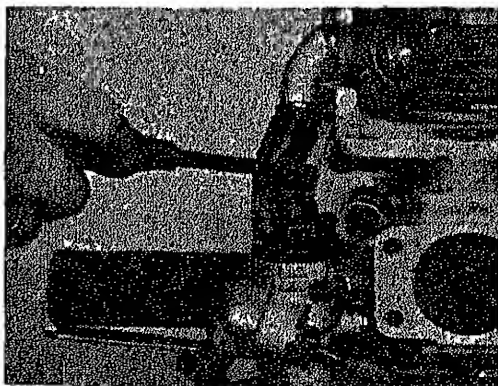


Fig. 19. The suction hose is wrenched off the suction pipe with a screw-driver.





13 Motor cylinder ..... Fig. 23

14 Piston rings 9210 0406, 9210 0229 and (after removing the compressor cylinder, according to point 15 below) 9210 0230 for motor piston and piston rings 9210 0131 for striking piston. Use tool 9201 0360 ..... Fig. 39

If these piston rings are still usable, they should be placed in their original piston ring grooves. The rings should be fitted in the same way as previously and they must not be turned upside down. For this reason put the rings on top of each other in the correct order when they are dismantled.

15 Compressor cylinder ..... Fig. 24

See that the sealing rings 9210 0132 are replaced in the same order as they had before being removed and that they are not turned.



Fig. 20. Removing the suction pipe from the cylinder

Fig. 21. Removing the suction valve from the cylinder. NOTE — The suction and delivery valves are identical but fitted differently. (See Fig. 18.)

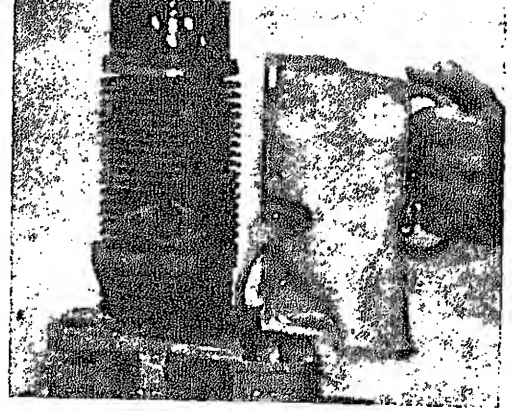
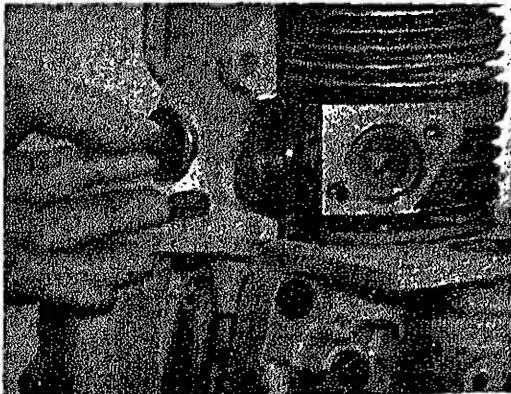


Fig. 22. Dismantling the cooling duct from the crankcase by unscrewing the two screws

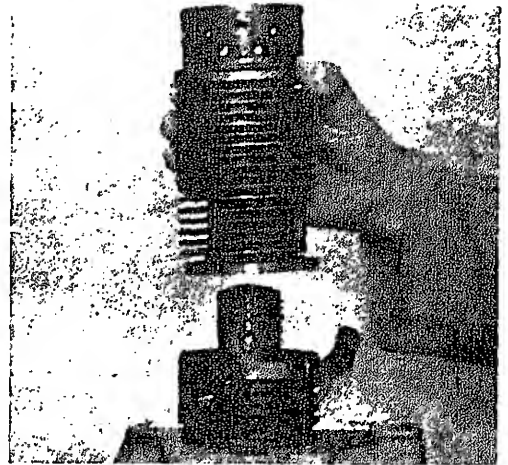
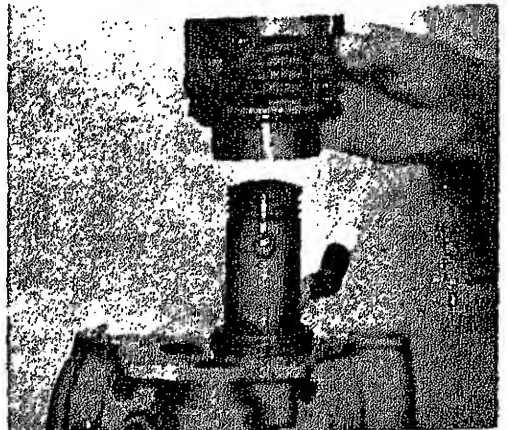


Fig. 23. The motor cylinder is carefully lifted from the compressor cylinder.

Fig. 24. The compressor cylinder is lifted from the crankcase



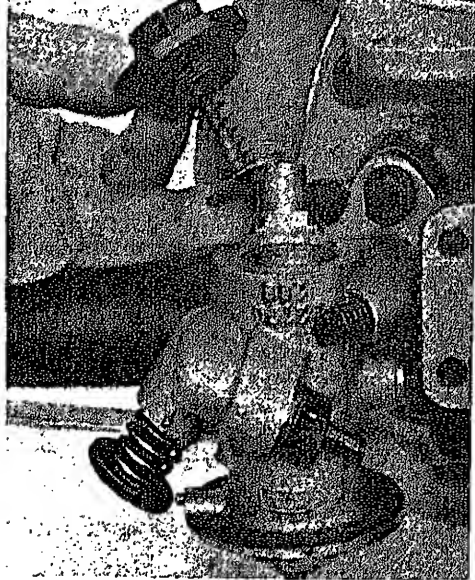


Fig 25. Unscrew the carburettor cover after which valve with spring can be removed

- ⑥ Carburettor cover 9210 0401, fuel spring and carburettor valve ..... Fig. 25
- ⑦ Nipple 9210 0401 with fuel strainer 9210 0403 ..... Figs. 26—27
- ⑧ Fuel adjustment screw 9210 0372, spring 9210 0374 and valve sleeve 9210 0199 ..... Fig. 28
- ⑨ Link 9210 0305 — Loosen it from the carburettor by pulling out pin 9210 0306. Remove carburettor ..... Fig. 29

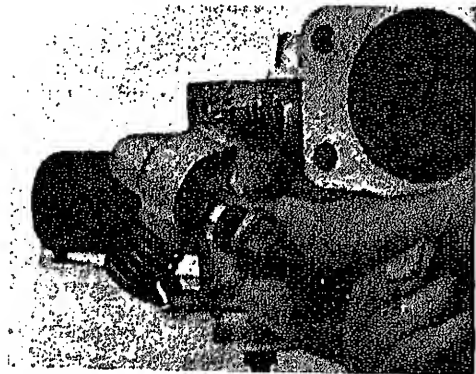


Fig 26. Dismantling nipple with fuel strainer

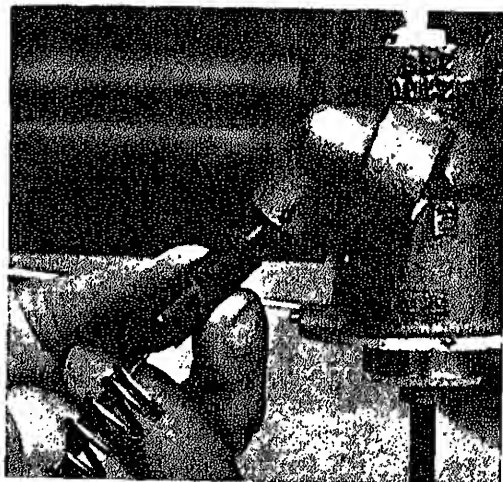


Fig. 28. Dismantling fuel adjustment screw with valve sleeve and spring.

Fig 27. Unscrew the fuel strainer from the nipple.

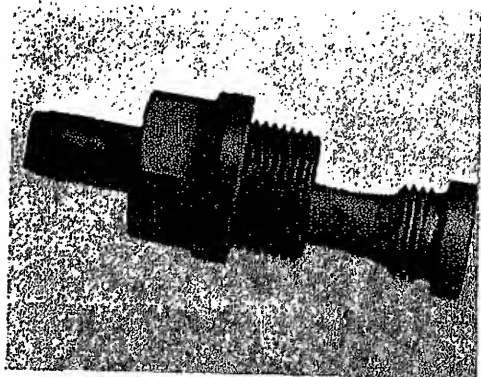


Fig. 29. Remove link from the carburettor by pulling out the pin.



Check that no oil has leaked past the sealing ring 9210 0509 which is pressed into the stator. If leakage has occurred, the sealing ring must be replaced.

21 Screw cap 9210 0284

22 Dice 9210 0154-80 with needle bearing 515 0429 ..... Fig. 31

23 Cover 9210 0315 in crankcase half

24 Motor piston 9210 0105 — For removing and fitting the gudgeon pin 9210 0109 use tool 9201 0255-80 .... Fig. 32

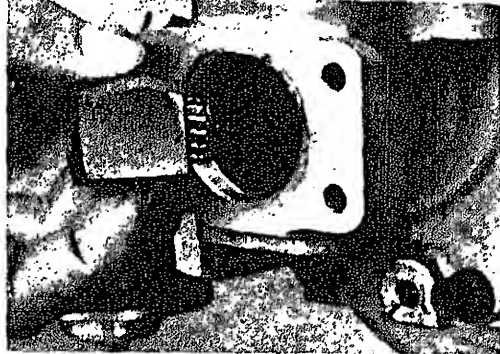


Fig. 31. After having removed the screw cap 9210 0284 from the crankcase, the dice and needle bearing can be dismantled.

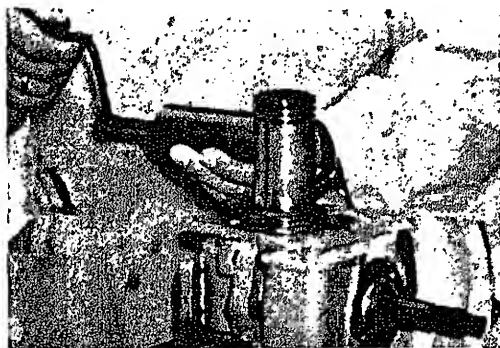


Fig. 32. Removing the gudgeon pin by means of tool 9201 0255-80.

Fig. 30. Remove stator from crankcase by means of a few light taps on the mandrel.

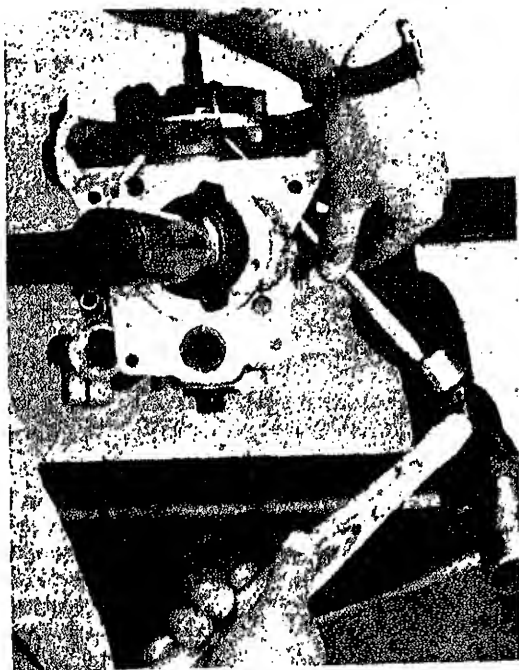


Fig. 33. After having unscrewed all the nuts, the stud bolts should be driven down about 5 mm (0.197 in) by means of a mandrel so that they no longer engage in one of the crankcase halves.



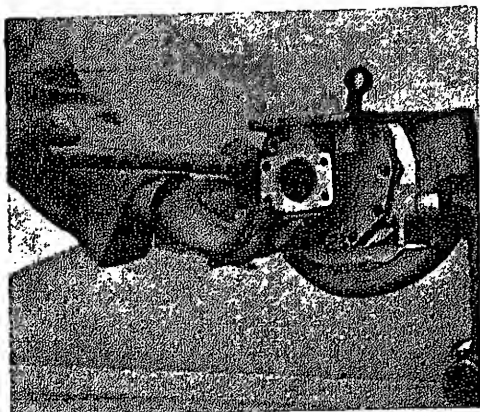


Fig. 34. The crankcase is divided after a few light taps on the crankcase half with a plastic hammer or the like.

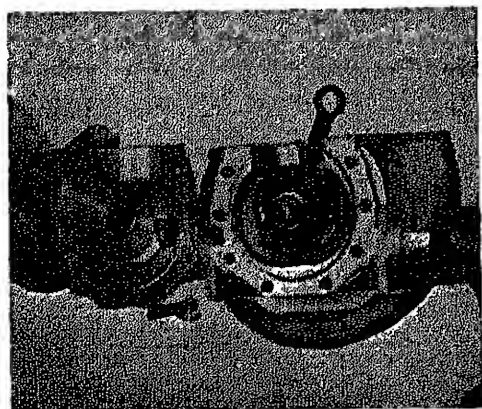


Fig. 35. The crankcase halves after dividing.

- 25 Crankcase — Unscrew the nuts 265 1110 which keep the crankcase halves together. The stud bolts should be driven down about 5 mm (0.197 in.) with a mandrel so that they no longer engage in one of the crankcase halves. The crankcase can then be divided ..... Figs. 33—34—35

*Because the dice has been removed earlier, see Fig. 31, the turning fork 9210 0126 can jam the crankcase half. Therefore check that the turning fork is in such a position that it is possible to remove the crankcase half.*

- 26 The sealing ring 9210 0509 should be replaced if grease has penetrated into the crankcase.

- 27 Crankshaft 9210 0453 ..... Fig. 36

## Cleaning

Wash all parts in white spirits, paraffin or some other suitable detergent after dismantling. Do not wash bearings and delicate machine parts together with other parts in the same detergent. The stone dust on external parts mixes with the detergent and can easily penetrate into bearings or be deposited on sliding surfaces and destroy them. Hot or corrosive baths must not be used when washing, as they may have an injurious effect on some parts.

## Upper section with motor

### Inspection of parts

#### Motor cylinder

COBRA, type ..... BBM 47L

Motor cylinder .... Part No. 9210 0101 9210 0520

Remove carbon deposits from the exhaust port and the cylinder bores. Check the cylinder bore and measure the cylinder diameter. For the cylinder to last yet another overhauling period, the cylinder diameter should not exceed 45.16 mm (1.7780 in.). The cylinder is, however, completely worn out if the diameter exceeds 45.22 mm (1.7799 in.).

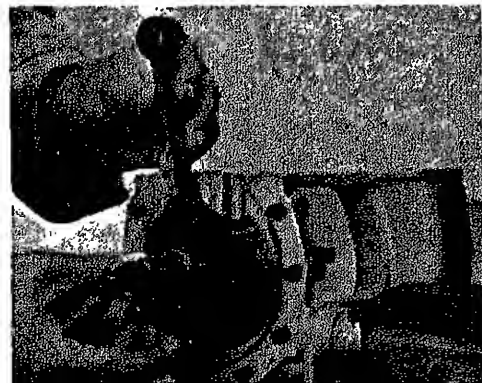


Fig. 38. Removing the crankshaft from the crankcase.

available, a new piston ring 9210 0229 can be used for checking the cylinder diameter. Measure the gap between the ring ends when the piston ring has been placed in the measuring ring 9201 0361, which has exactly the diameter of a new cylinder. See Fig. 37. Then introduce the piston ring into the cylinder with the aid of the piston so that the ring will be perpendicular to the cylinder. Place the piston ring about 20 mm (0.8 in.) from the spark plug hole (see Fig. 38), and measure the ring gap again.

If the gap exceeds 0.5 mm (0.020 in.), this corresponds to a cylinder diameter of 45.16 mm (1.7780 in.). The gap may, however, exceed the gap which was obtained in the measuring ring 9201 0361, see Fig. 37, by not more than 0.6 mm (0.024 in.) in order to correspond to a maximum cylinder diameter of 45.20 mm (1.7795 in.).

If a measuring ring is not available, the ring opening should be assumed to be 0.25 mm (0.0098 in.) which should be added to the above-mentioned measurements of 0.5 mm (0.020 in.) and 0.6 mm (0.024 in.).

### Piston rings

Check the piston rings in the measuring ring 9201 0361 as shown in Fig. 37.

The gap between piston ring ends may be as indicated below:

Piston ring Part No.	Recommended renewal		Maximum gap	
	mm	in.	mm	in.
9210 0229	0.6	0.024	0.8	0.032
9210 0230	0.6	0.024	0.8	0.032
9210 0131	0.6	0.024	0.8	0.032
9210 0406	—	—	0.6	0.024

Use tool 9201 0360 for removing the piston rings from striking piston and motor piston. The same tool should be used when fitting the piston rings. See Fig. 39.

### Compressor cylinder 9210 0452-80

Measure the cylinder diameter. The cylinder should be replaced if the diameter exceeds 60.15 mm (2.3681 in.).

If the amount of wear is measured with a new piston ring 9210 0230, the gap between the ring ends may be not more than 0.5 mm (0.020 in.) larger than the measurement obtained in measuring ring 9201 0361.

If a measuring ring is not available, the ring opening should be assumed to be 0.25 mm (0.0098 in.) which should be added to the above-mentioned measurement of 0.5 mm (0.020 in.).

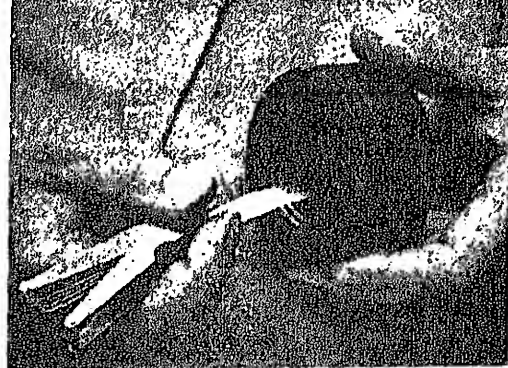


Fig. 37. Measuring the piston ring clearance in measuring ring 9201 0361.

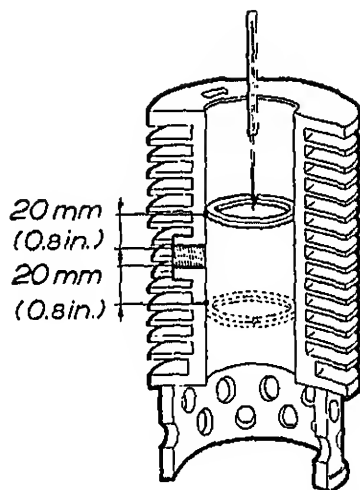
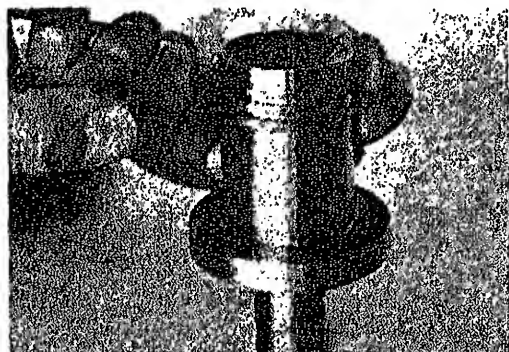


Fig. 38. Place the piston ring about 20 mm (0.8 in.) from the spark plug hole and measure the piston ring with a feeler gauge.

Fig. 39. Removing the piston rings from the striking piston by means of tool 9201 0360.





### Motor piston 9210 0105

Clean off any carbon deposits on the piston. Check the clearance between the piston ring and the piston ring groove. See Fig. 40. With a new piston ring it must not exceed 0.2 mm (0.008 in.).

The piston is tapered downwards from the top for a distance of 28 mm (1.1 in.), the remaining portion being cylindrical. The permissible minimum diameter of the piston is 44.85 mm (1.7657 in.), measured on the cylindrical part about 50 mm (2 in.) from the piston top. The piston becomes worn to a slightly oval shape. Therefore the measurement should be taken square to the gudgeon pin where the wear is greatest. When renewing the piston, the sealing rings 9210 0132 should also be replaced.

### Sealing rings 9210 0132

The sealing rings serve to tighten against the motor piston and therefore have an inward tension. In other words, they tend to keep tight on to the piston. The sealing ring gap consequently decreases as the piston and the rings become worn. If the gap is below 0.3 mm (0.012 in.) the sealing ring ends must be filed off

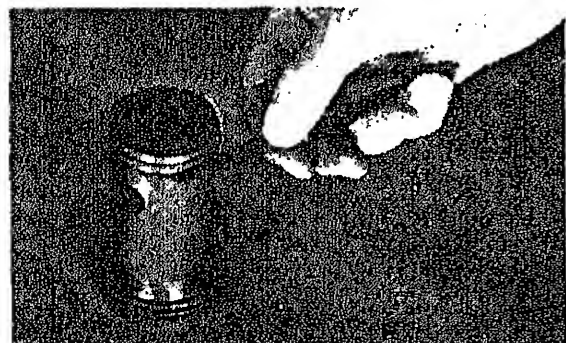
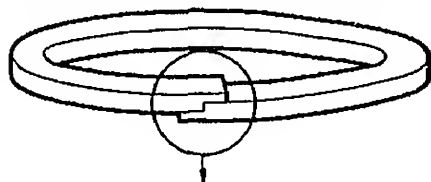


Fig. 40. Measuring the clearance between piston ring and piston ring groove. With a new piston ring the clearance must not exceed 0.2 mm (0.008 in.).

Fig. 41. The sealing ring ends should contact each other at the arrow for the tension to be satisfactory.



until a gap of 0.3—0.4 mm (0.012—0.016 in.) is obtained. The tension of the rings must also be checked. This can best be done by prizing the ring apart, so that the ends overlap each other. See Fig. 41. If the faces at the arrow seat on each other, the tension is satisfactory. Otherwise the ring should be renewed. The sealing rings should not be replaced as long as the motor piston is useable, unless absolutely necessary. Well worn in as they are, the old rings, of course, seal better than new rings.

If the rings have to be renewed for one reason or another, check that the ovality of the motor piston is not above 0.05 mm (0.0020 in.). If the ovality exceeds this figure the piston must also be renewed. The original position of the piston rings should be maintained. The piston rings must not be turned. The rings also fit when turned, but because of the ovality of the motor piston, they do not seal properly.

### Striking piston 9210 0437

Remove any carbon deposits on the striking piston.

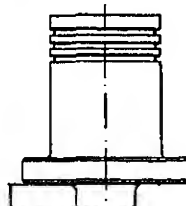
**Note** — When cleaning the striking piston, its upper edge should be protected against damage. Check with one of your fingernails that there are no marks, burrs, etc., on the upper edge or in the piston ring grooves. Even if a mark is not visible with the naked eye, it may in its turn cause marks in the cylinder bore.

Existing marks can be removed with a fine grade whetstone. Great care should be taken not to finish the upper edge of the striking piston with emery cloth. The radius there should only be 0.1—0.2 mm (0.004—0.008 in.).

Check the clearance between the piston ring and the piston ring groove. With a new piston ring it must not exceed 0.2 mm (0.008 in.). The diametrical wear on the striking piston is very small. Renewal of the piston for this reason is therefore not required.

The face of the striking piston becomes gradually worn by the tool shank. When the wear has caused a recess of B = about 0.5 mm (0.020 in.), see Fig. 42,

Fig. 42. When the face of the striking piston is worn, the face should be ground. The height A must not be less than 48.5 mm (1.83 in.) and the recess B must not exceed 0.5 mm (0.020 in.).



striking piston must not be less than 40.5 mm (1.63 in.). If, after grinding the striking face, no bevel remains in the outer edge, the sharp edge should be bevelled in order to eliminate fractural impressions. Then check that the cylindrical guide is free from burrs.

Inspection, and possible grinding, of the striking piston should be carried out in connection with tool chuck renewals.

#### Delivery valve and suction valve 1002 1170-80

Check that the riveting of the valve is not loose, that both springs are in good order and that the valve disc does not jam in an open position when the valve is fully opened. If the valve has any of these defects it should be replaced.

#### Suction hose 9210 0427

Check that the hose seals properly at the connections.

#### Delivery pipe 9210 0460

Check that the outer diameter of the portion of the pipe which is located in the lower section is not below 11.8 mm (0.465 in.).

#### O-ring 9210 0523

This sealing ring must be replaced if it has become compressed to less than 4 mm (0.158 in.). In a new ring the material is 5 mm (0.197 in.) in diameter.

#### Main bearings 515 4435

As a rule, the needle bearings should be renewed when the needles are no longer retained in the needle cage. If one of the main bearings requires renewal, all three main bearings should be replaced, otherwise the new bearing will be exposed to abnormal stresses. When replacing the main bearings, the axial bearing rings 9210 0227 and the sealing rings 9210 0509 should also be renewed. See below.

#### Axial bearing rings 9210 0227

If these rings are so heavily worn that the crankshaft wears on the crankcase, the bearing rings should be renewed. Always replace the bearing rings when renewing the main bearings.

Use tool 9201 0358 for fitting and removing the axial bearing rings and main bearings 515 4435. See Figs. 43 and 44.

edge of the new rings so that it faces the crankcase. Fit the ring with tool 9201 0244. See Fig. 45

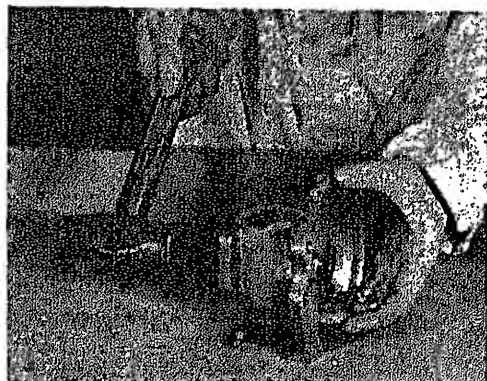


Fig. 43. Removing axial bearing ring and main bearing by means of tool 9201 0358

Fig. 44. Fitting axial bearing ring and main bearing by means of tool 9201 0358



The oblique rotation pin on the crankshaft is mainly worn at the ends. Care should therefore be taken to measure its smallest diameter. The clearance between the rotation pin and the needle bearing should not exceed 0.2 mm (0.008 in.). The needle bearing must be fitted in the dice when measuring this clearance. The needle bearings should be renewed if the needles are not retained in the needle cage.

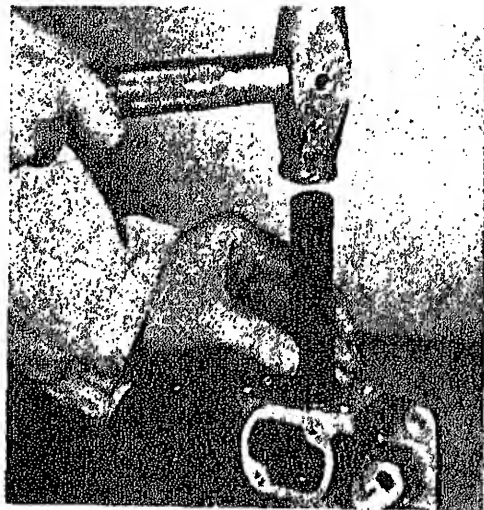
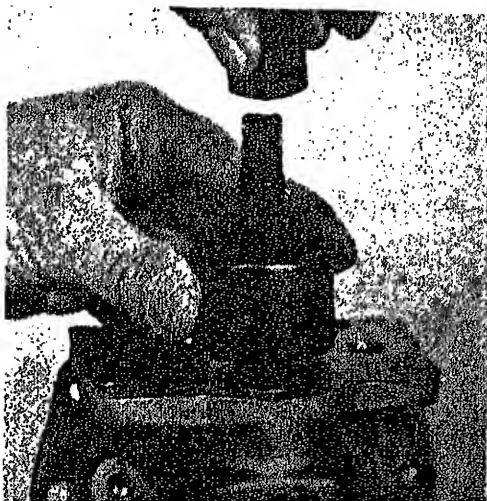


Fig. 45 Fitting sealing ring by means of tool 9201 0244.  
NOTE — Turn the sealing edge of the ring so that it faces the crankcase.

Fig. 46 Removing the sealing ring of the torsion shaft from the crankcase by means of tool 9201 0363. For fitting, use tool 9201 0243.



The permissible minimum diameter of the crankshaft at the main bearings is 19.97 mm (0.786 in.). If the diameter is smaller than this measurement, the crankshaft should be renewed.

The permissible maximum clearance between the gudgeon pin and the needle bearing in the connecting rod is 0.06 mm (0.0024 in.). If the clearance exceeds this measurement, the needle bearing should be renewed in the first place. If the clearance is still too large, the gudgeon pin should also be renewed. If necessary, also renew the connecting rod.

The permissible maximum clearance between the crank web and the needle bearing in the connecting rod is 0.07 mm (0.0028 in.). If the clearance exceeds this measurement, the needle bearing halves should be renewed in the first place. If the clearance is still too large, the connecting rod should also be renewed. If necessary, also renew the crankshaft.

The tightening torque of the connecting rod screws should be 0.8 kpm (6 ft. lb.).

#### Bushing 9210 0153 for turning fork

If the clearance between the turning fork and the bushing exceeds 0.2 mm (0.008 in.), the journal of the turning fork should in the first place be checked. If the diameter exceeds 19.9 mm (0.783 in.) it is the bushing which is worn and should be renewed. Then first remove the sealing ring 666 4094 with tool 9201 0363. See Fig. 46. Use tool 9201 0351 for removing and fitting the bushing. See Figs. 47 and 48.

#### Turning fork 9210 0126

The permissible minimum diameter of the journal of the turning fork in the bushing 9210 0153 is 19.9 mm (0.783 in.). See under bushing 9210 0153. The wear between the turning fork and the dice 9210 0154-80 becomes conical, and the clearance should therefore be measured at two extreme point of the fork, that is just inside the bore on the turning fork. The clearance should not exceed 0.2 mm (0.008 in.). The dice should in the first place be renewed.

#### Dice 9210 0154-80



For dismantling, see chapter "Dismantling"

## Inspection of parts

### Fuel tank

To remove any dirt in the fuel tank, rinse the tank in petrol and dry it by air blast. See that the petrol pipe 9210 0331 is undamaged.

The filter 9210 0330 at the ventilation hole in the fuel tank should be replaced.

### Air filter 9210 0408

First check that the filter element is undamaged. If the stud 9210 0336 is covered with dust particles, there is probably a hole in the filter element. If this is the case, the air filter must be replaced.

If the air filter is in good order, it should be rinsed in white spirits or petrol (not mixed with oil), preferably in two baths.

If the filter casing 9210 0145 is deformed it must be straightened, otherwise it can damage the filter element.

It is very important that the nut 9210 0646 is firmly tightened so that it seals properly against the filter casing. Normally, the air filter should be replaced at each major overhaul.

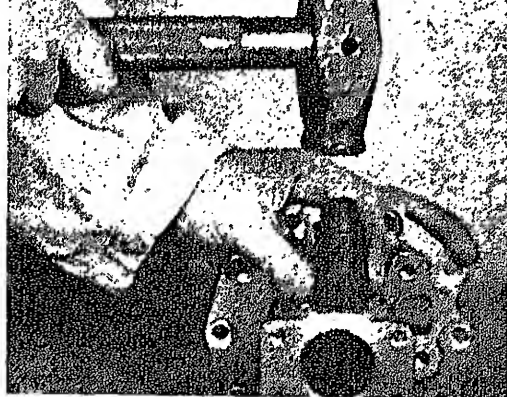


Fig. 48. Fitting the bushing of the turning fork by means of tool 9201 0351.

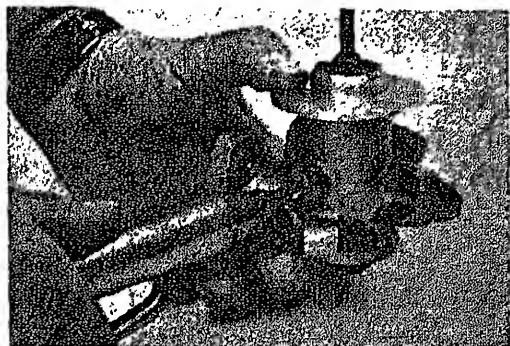


Fig. 49. Cleaning the fuel channels by blowing air through them.

Fig. 47. Removing the bushing of the turning fork by means of tool 9201 0351.

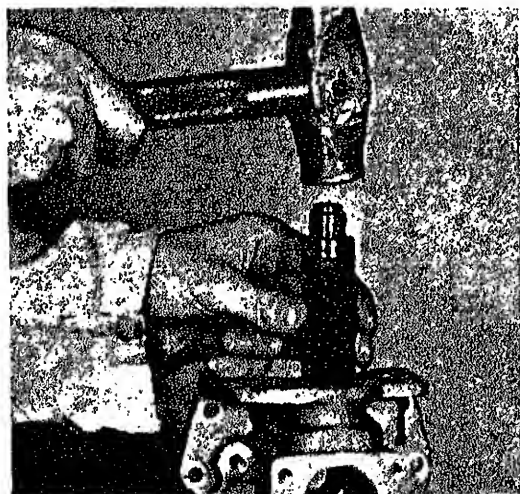
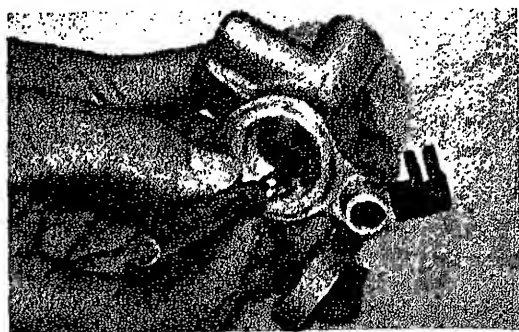


Fig. 50. Cleaning the four small holes in the carburettor seat with the cleaning needle 1600 0294-82, which is supplied with the machine.



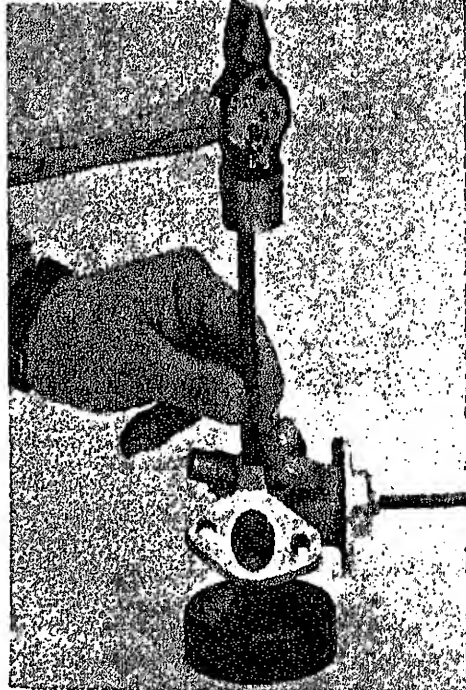
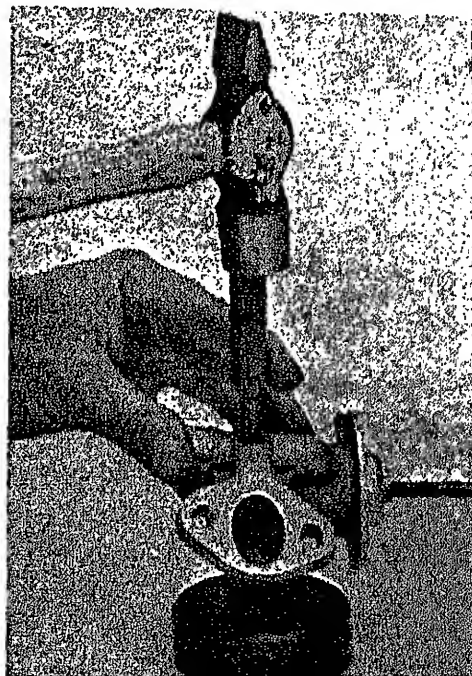


Fig. 51. Removing the bushings of the throttle shaft by means of tool 9201 0236.

Fig. 52. Fitting the bushings of the throttle shaft by means of tool 9201 0235-80.



The hole shown in Fig. 49 permits cleaning the fuel channels by blowing air through them.

Clean the four small holes in the carburettor seat with the cleaning needle 1600 0204-84, which is supplied with the machine. See Fig. 50. Fit the carburettor in petrol or white spirit and dry it by air blast.

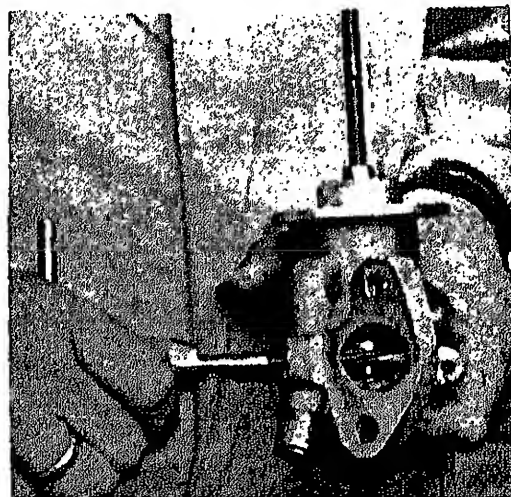
Fast if the throttle shaft 9210 0308-80 is long. The permissible maximum clearance between the shaft and the bushings, 9210 0485 and 9210 0486 respectively, is 0.2 mm (0.008 in.). If it is above this figure, the bushings should in the first place be renewed. Use tool 9201 0236 for removing the bushings. See Fig. 51. Use tool 9201 0235-80 for fitting the bushings. See Fig. 52.

#### Bushings 9210 0485 and 9210 0486 for carburettor casing

See above under "Carburettor" and Figs. 51 and 52. After having been fitted, the bushings should be reamed with reamer 9201 0205. See Fig. 53.

Sealing washers 9210 0484 should be renewed.

Fig. 53. Reaming the bushings of the throttle shaft by means of reamer 9201 0205.



### Guide pin 9210 0446 of carburettor valve

Check the diameter. The permissible minimum measurement is 3.9 mm (0.154 in.). Use tool 9201 0354 for removing the pin. See Fig. 54. Use tool 9201 0364 for fitting the pin. See fig. 55.

### Carburettor valve 9210 0193

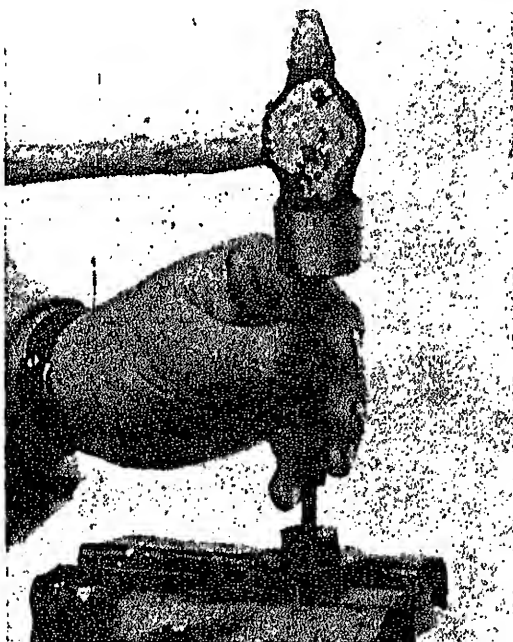
The clearance between the guide pin and the carburettor valve must not exceed 0.15 mm (0.006 in.). If it is above this figure, the carburettor valve should be renewed. The sealing face of the carburettor valve should be checked by means of marking ink. If the face is not flat, it should be dressed with a fine-grade grinding paste on a flat block of smooth cast-iron.

The valve opening on a new valve should be 2.1—2.3 mm (0.083—0.091 in.). The permissible maximum opening is 2.5 mm (0.098 in.). The distance should be measured with a depth micrometer. First take the measure according to Fig. 56a, then measure as shown in Fig. 56b. Subtracting the measure according to b from the measure according to a gives the valve opening.

### Valve spring 9210 0209

If the length of the spring is below 28.5 mm (1.122 in.), it should be renewed.

Fig. 54. Removing guide pin of carburettor valve by means of tool 9201 0354.



### Adjusting screw 9210 0372 for fuel supply

The tip of the screw must not stick more than 1 mm (0.04 in.) out of the valve sleeve 9210 0199, when the adjusting screw is screwed in completely. If this measure is exceeded, both the sleeve and the screw should normally be renewed. The fuel adjusting screw should also be renewed if it shows signs of wear.

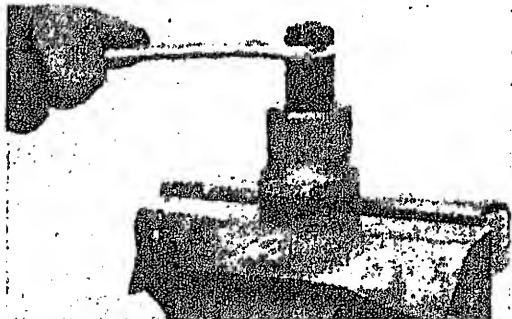


Fig. 55. Fitting guide pin of carburettor valve by means of tool 9201 0364.

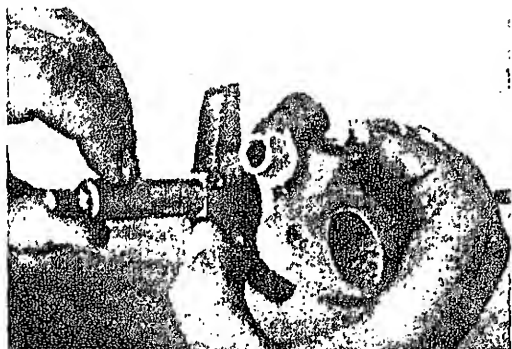
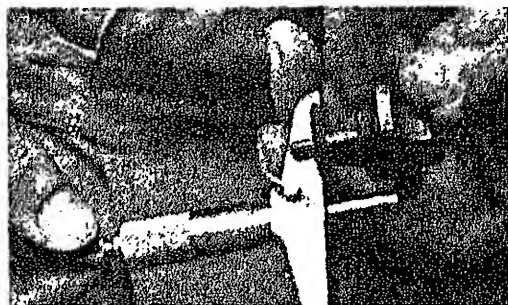


Fig. 56a

Fig. 56b. First take the measure according to Fig. 56a, then measure as shown in Fig. 56b. Subtracting the measure according to operation b from the measure according to a gives the valve opening, which should not exceed 2.5 mm (0.098 in.).



## LOWER SECTION FOR DMM 412 — dismantling

Dismantle the various parts in the following order and clean them according to chapter "Cleaning":

- ① Tool chuck with ratchet wheel  
9210 0482-80 (3/4") or 9210 0440-80  
(7/8") ..... Fig. 57
- ② Bottom plate 9210 0809 ..... Fig. 58
- ③ Socket screw 9210 0624 for feed .... Fig. 59
- ④ Feed 9210 0458 with pin ..... Fig. 60

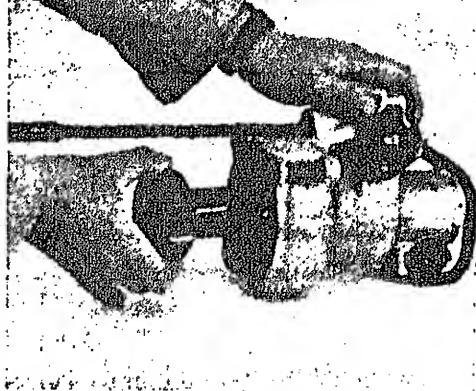


Fig. 57. Removing tool chuck with ratchet wheel.

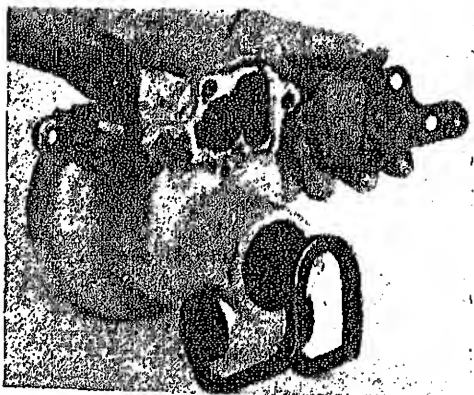


Fig. 58. Removing bottom plate.

Fig. 59. Removing socket screw for feed.

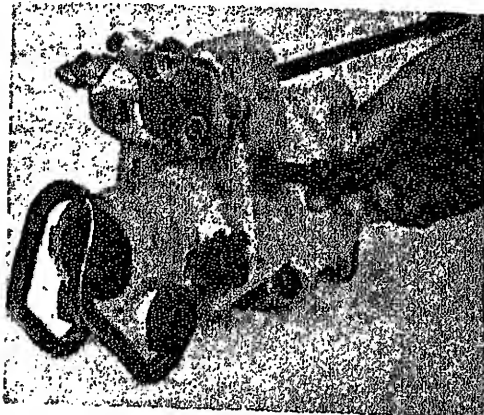
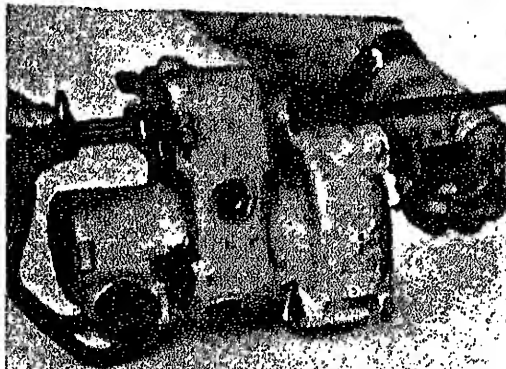


Fig. 60. Removing feed with pin.



- 5 Torsion shaft 9210 0613 with crank piece ..... Fig. 61
- 6 Selector 9210 0612-80 with dial and handle ..... Figs. 62—63—64
- 7 Socket screw 9210 0665 for pawl 9210 0727 ..... Fig. 65



Fig 61. Removing torsion shaft with crank piece.

Fig 62 Removing handle and dial.



Fig. 63. Removing protective plate and press button.

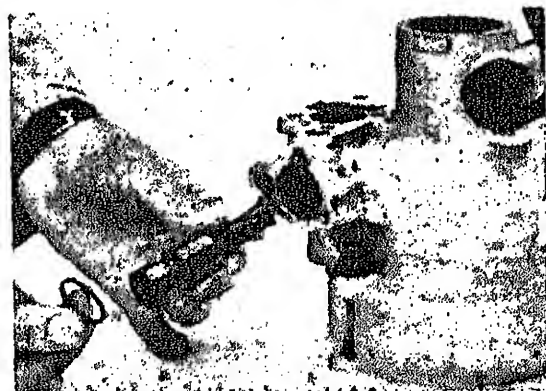
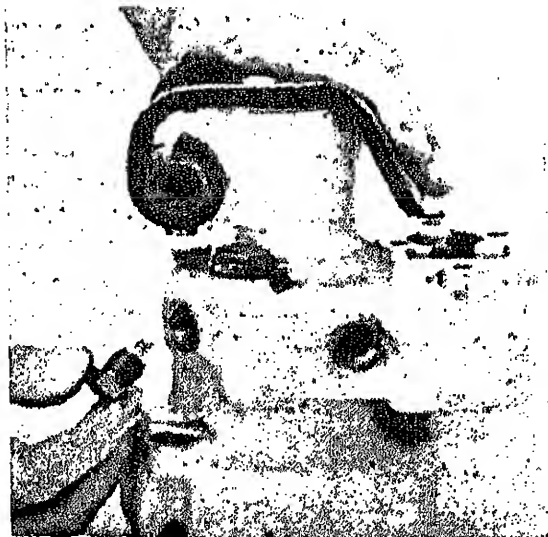
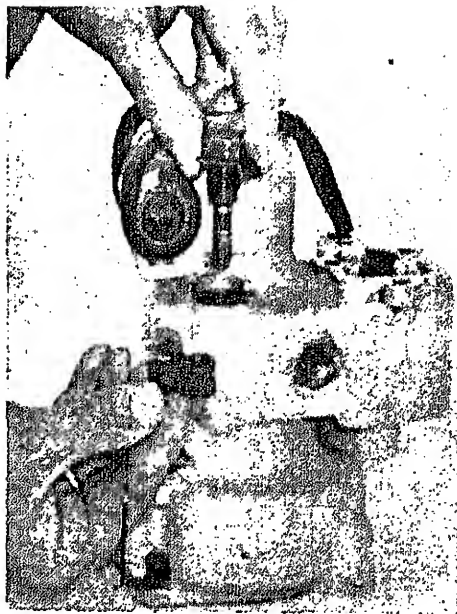


Fig. 64. Removing selector.

Fig. 65 Removing socket screw for pawl.







66 Removing pawl with pivot shaft.

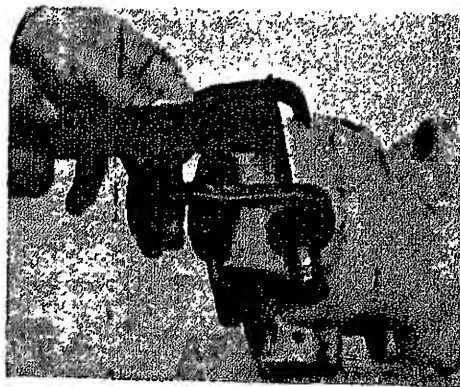
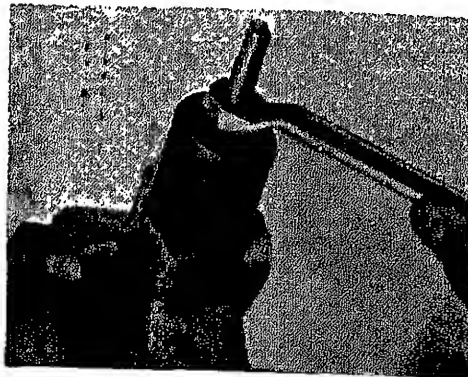


Fig 67 Removing tool retainer by means of tool 9201 0223

Fig 68 Removing bushing for selector by means of tool 9201 0398-80.



- ⑧ Pawl 9210 0727 with pivot shaft 9210 0623 ..... Fig. 66
- ⑨ Tool retainer 9210 0483 ..... Fig. 67
- ⑩ Bushing 9210 0611 for selector .... Fig. 68

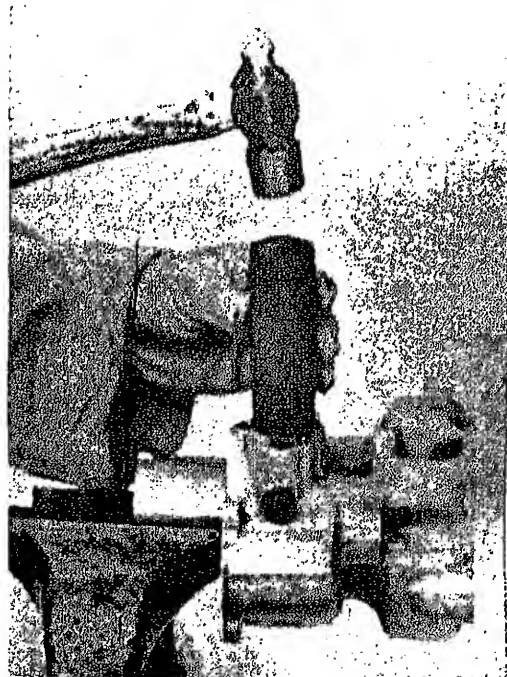
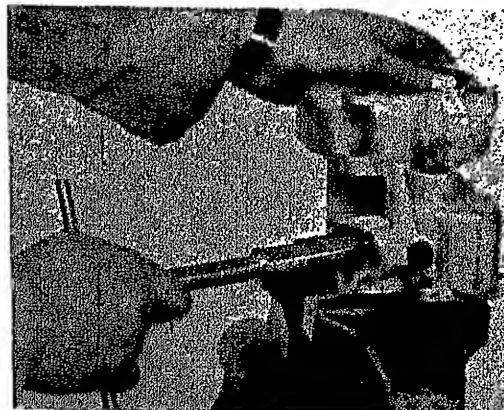


Fig. 69. Fitting bushing for selector by means of tool 9201 0393.

Fig. 70. Lapping bushing for selector by means of tool 3091 0336-80.



- ⑪ Bushing 9210 0615 and sealing rings 9210 0668 for torsion shaft ..... Fig. 71
- ⑫ Sleeve 9210 0622 for pivot shaft 9210 0623 ..... Fig. 74

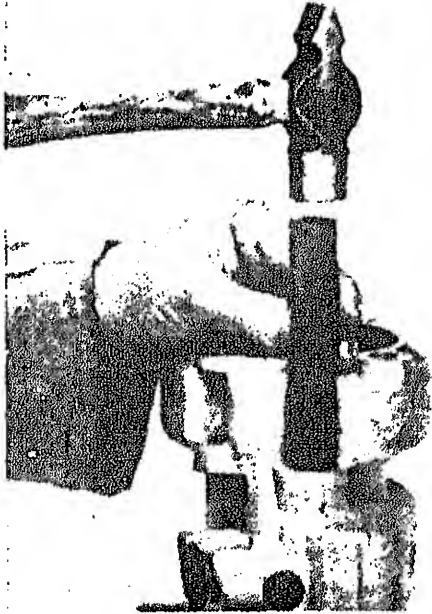


Fig. 71. Removing bushing 9210 0615 and sealing rings for torsion shaft by means of tool 9201 0396.

Fig. 72 Fitting sealing rings and bushing 9210 0615 for torsion shaft by means of tool 9201 0396.

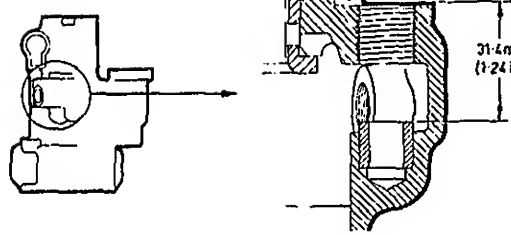
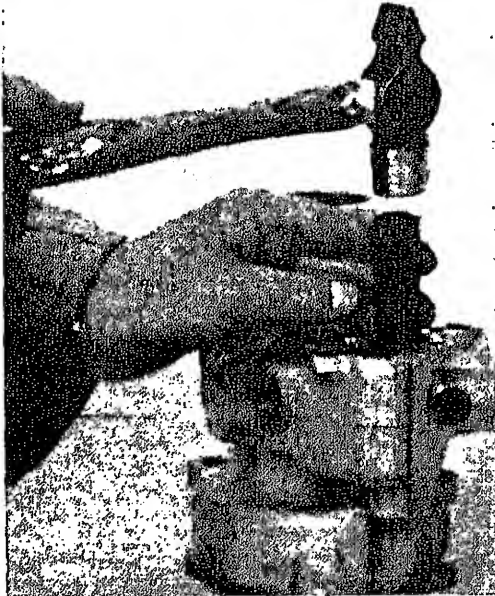


Fig. 73. If the distance is 31.4 mm (1.24 in.) or more, the sleeve should be renewed.

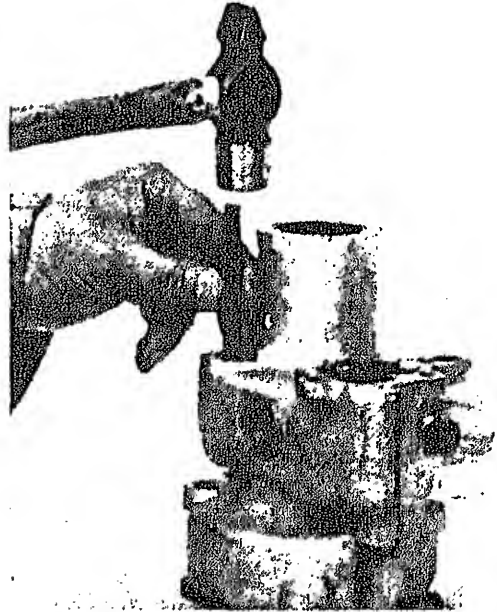
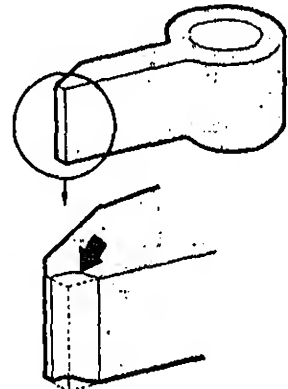


Fig. 74. For removing the sleeve, pour oil in it and then place tool 9201 0395 in the sleeve. When tapping the mandrel, hydraulic pressure is obtained under the sleeve which removes it.

Fig. 75. The pawl should be renewed if worn as marked by the white area.



0.2 mm  
(0.009 in.)

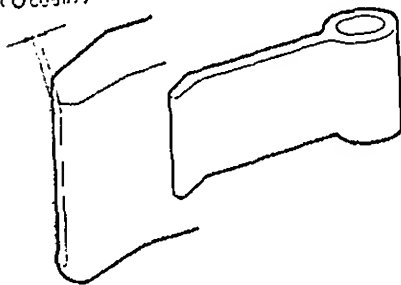
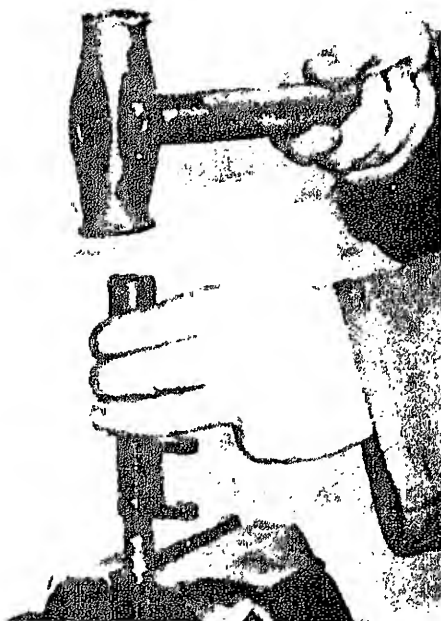


Fig. 77 The feed should be renewed if the amount of wear on the nose exceeds 0.2 mm (0.009 in.)



Removing the crank piece from the torsion shaft by means of tool 9201 0202 80

Fig. 78 Fitting the crank piece on the torsion shaft by means of tool 9201 0206.



- 13 Crank piece 9210 0014 of the torsion shaft ..... Fig. 77
- 14 Bushing 9210 0481 for tool chuck ... Fig. 80
- 15 Ratchet wheel 9210 0425 (Fig. 81 shows fitting)

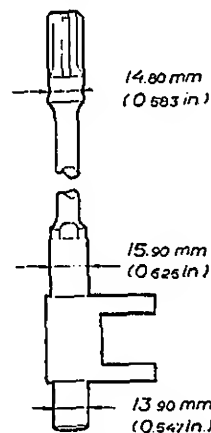


Fig. 79. Renew the torsion shaft when it is worn below diameters stated in the figure.

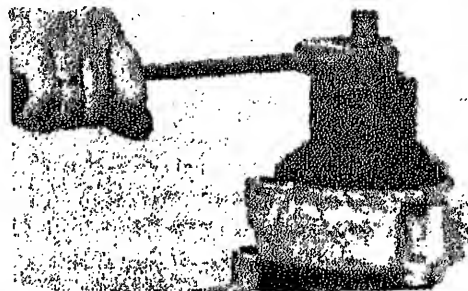
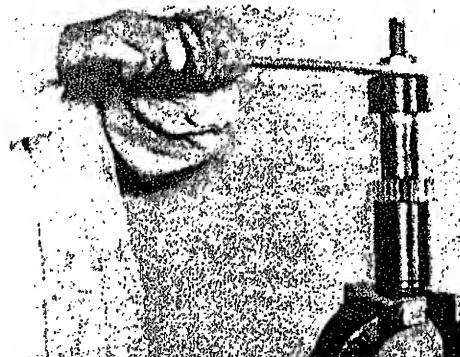


Fig. 80. Removing the bushing of the tool chuck by means of tool 9201 0362. Use the same tool for fitting

Fig. 81. Fitting ratchet wheel on tool chuck by means of tool 9201 0362. Use the same tool for removing it.





### **Inspection of parts for lower section (BBM 47L)**

#### **Tool retainer 9210 0483 with pertinent parts**

No figures for the permissible wear of these parts can be given. Renewals are necessary when the parts are found not to give satisfactory service. Use tool 9201 0223 for removing and fitting the tool retainer. See Fig. 67.

#### **Bushing 9210 0611 for selector**

If the clearance between the selector and the bushing exceeds 0.1 mm (0.004 in.), both the bushing and the selector should be renewed. Use tool 9201 0398-80 for removing the bushing. Fig. 68, and tool 9201 0393 for the fitting. Fig. 69. The holes in the bushing should face directly against the corresponding holes in the lower section.

After having been fitted, the bushing should, if required, be lapped with lapping tool 3091 0336-80 so that the selector moves smoothly in the bushing. See Fig. 70.

#### **Selector 9210 0612-80**

Check by means of drills having a diameter of 2 mm and 2.3 mm (0.079 in. and 0.091 in.) that the holes for the air passage in the selector are not clogged up. Check that the surfaces on the selector, which keep the feed from the ratchet wheel, are not so much worn that free run of the ratchet wheel is not obtained. See also bushing 9210 0611 above.

#### **O-ring 663 3127 for selector**

Renew the O-ring if it is so much worn that it is not in contact with the selector.

#### **O-ring 9210 0511 for delivery pipe**

Renew the O-ring if it is damaged or deformed so that it does not seal between the lower section and the delivery pipe.

#### **Bushing 9210 0615 for torsion shaft**

The inside diameter must not exceed 16.05 mm (0.6319 in.). Use tool 9201 0396 for removing and fitting the bushing. See Figs. 71 and 72.

#### **Sealing rings 9210 0668 for torsion shaft**

Replace the sealing rings when renewing the bushing 9210 0615. If only the sealing rings require renewal, remove both rings and bushing with tool 9201 0396, Fig. 71, and use the same tool for fitting new rings and the bushing. Fig. 72.

#### **Sleeve 9210 0622 for pivot shaft**

Renew the sleeve if worn so that the distance according to Fig. 73 is 31.4 mm (1.24 in.) or more. Use tool 9201 0395 for removing the sleeve. See Fig. 74.

#### **Pivot shaft 9210 0623**

The diameter of the pivot shaft must not be less than 8.8 mm (0.347 in.). If below this figure, the shaft should be renewed. The tightening torque of the pivot shaft should be 10 kpm (72 ft. lb.).

#### **Pawl 9210 0727**

The pawl should be renewed if it is worn as shown in Fig. 75.

#### **Feed 9210 0456**

The feed should be renewed if the amount of wear on the nose exceeds 0.2 mm (0.008 in.). See Fig. 76.

#### **Pin 9210 0617 for feed**

Renew the pin when so much worn that its diameter is less than 13.85 mm (0.5457 in.).

#### **Pawl spring 3111 0023**

Should be renewed at each major overhaul.

#### **Spring 9210 0722 for socket screw**

Should be renewed at each major overhaul.

#### **Crank piece 9210 0614**

Replace the crank piece when the holes for the pin exceed 14.05 mm (0.5536 in.) in diameter. Use tool 9201 0202-80 for removing the crank piece and tool 9201 1206 for the fitting. See Figs. 77 and 78.

#### **Bushing 9210 0616 for torsion shaft at the bottom plate**

The inside diameter must not exceed 14.1 mm (0.555 in.).

#### **Torsion shaft 9210 0613**

Renew the shaft when it is worn to measurements below the minimum diameters according to Fig. 79.

#### **Bushing 9210 0481 for tool chuck**

Check the clearance between the tool chuck and the bushing. If the clearance exceeds 0.2 mm (0.008 in.), the bushing should be renewed. Use tool 9201 0362 for removing and fitting the bushing. See Fig. 80.

Tool chuck 9210 0482-80 (3/4").

9210 0440-80 (7/8")

Check with gauge 3007 0125 (3/4") or 3091 0038 (7/8"). See Fig. 1. If the gauge goes in completely, the chuck is worn out and should be replaced. Use tool 9201 0362 for removing and fitting the ratchet wheel 9210 0425. See Fig. 81.

#### Ratchet wheel 9210 0425

The ratchet wheel should be replaced if the teeth are so worn that the feed 9210 0458 or the pawl 9210 0727 do not engage properly. See tool chuck above.

Packing 9210 0324 (3/4"),

9210 0400 (7/8")

If the packing is damaged, or if the measure between two flats of the hexagon is more than 18 mm (0.709 in.) and 21 mm (0.827 in.) respectively, the packing should be renewed.

#### Intermediate part 9210 0438

The permissible maximum clearance between the outer diameter of the striking piston and the hole in the intermediate part is 0.1 mm (0.004 in.). If it is above this figure, the intermediate part should be renewed.



Fig. 108 Removing the circle p from the guide sleeve of the start wheel

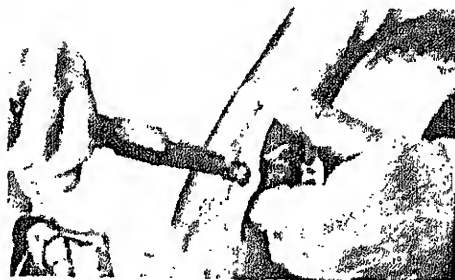


Fig. 109 Removing the starting wire from the handle.

## Starter

The dismantling procedure is shown in Figs. 109 and 110.

### Inspection of parts

#### Start wheel 9210 0295

The clearance between the start wheel and the sleeve 9210 0291 must not exceed 0.3 mm (0.0118 in.). If this figure is exceeded, the inside diameter of the start wheel should be checked. If the diameter exceeds 23.8 mm (0.937 in.) the start wheel should be replaced. If the diameter is below this figure, the guide sleeve should be renewed. If the start wheel is worn close to the handle but is otherwise

Fig. 110 Removing the spring of the start wheel starter casing.



additional period. The length of the wire should not, however, be less than 1.5 m (1.64 yd.). The wire should be fitted as shown in Figs. 111 and 112.

#### Guide sleeve 9210 0291

If the guide sleeve requires renewal, it can be driven out without using any special tool. When refitting, do not forget the key 338 3108. See start wheel above.

If the teeth of the start wheel are staved up, the burrs should be ground off. When fitting, inject a little grease into the lubricating groove on the guide sleeve. See Fig. 113.

### Flywheel magneto and spark plug

The component parts of the stator disc are shown in Fig. 114. See that none of the parts fitted to the stator disc is damaged and check that the cables and connections are free from defects. If the condenser, coil, contact breaker body or contact arm require renewal, the first step should be to see how the cables are connected, to ensure proper reconnection after the renewal. Note the placing of the cables.

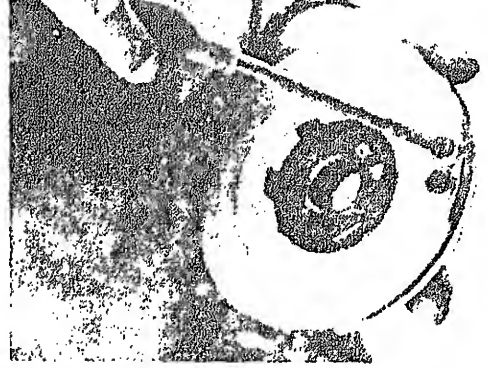


Fig. 112. The connection of the starting wire at the start wheel.



Fig. 113. When fitting, fill the lubricating groove on the guide sleeve of the starter casting with grease.

Fig. 111. The figure shows how the spring should be fitted in relation to the wire. When fitting, the spring should be tightened one revolution. As the spring is mounted anti-clockwise on the start wheel, the starting wire is mounted in the opposite direction.

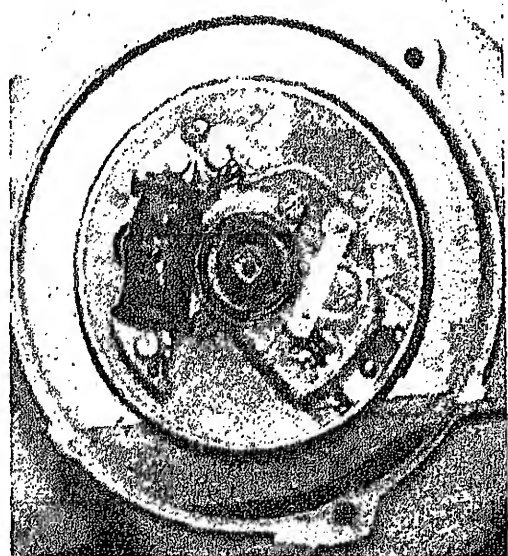
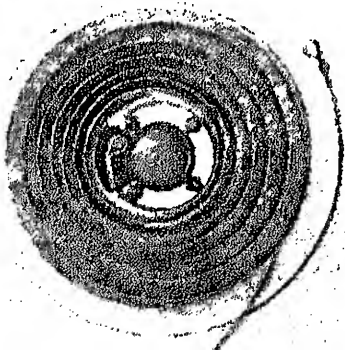


Fig. 114. Stator with ignition coil, condenser and contact breaker.

#### Contact breaker device

If the breaker points have become burned, they should be reconditioned with the file included in the tool box, or with a fine-grade whetstone.

See that no impurities are left between the contact points after reconditioning. If the breaker points are badly burned, this may be due to the condenser being faulty. The gap between the contact breaker points can be adjusted only after fitting the flywheel. See point 11 under the heading "Assembling" and Fig. 115.

The shaft (1) in Fig. 110, for the contact arm is provided with a lubricating groove which should be filled with grease each time the machine is taken apart for major overhaul. Remove the screw (2) and lock washer (3) and extract the arm (4) and refill with grease in the groove.

If dry, the lubricating felt for the cam should also be greased.

#### Sealing ring 9210 0309

The sealing ring should be replaced if, when dismantling the flywheel, the stator disc is found to be oily. The ring should be removed and fitted by means of mandrel 9201 0244. Be careful not to damage the contact breaker arm. See Fig. 117.

Fig. 117. Removing and fitting the sealing ring of the stator by means of mandrel 9201 0244. Be careful not to damage the contact breaker arm.

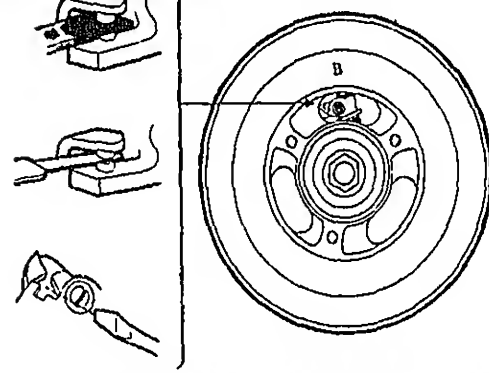
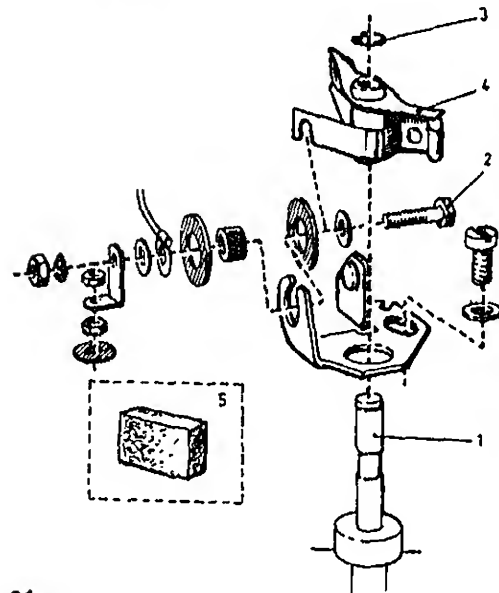


Fig. 115. Setting the distance between the contact breaker points.

Fig. 116. Exploded view of the contact breaker device. Remove the screws (2) and lock washer (3) and extract the arm (4). Refill with grease in the lubricating groove of the contact breaker shaft (1). If dry, the lubricating felt (5) for the cam should also be greased.



# **Cable clip 9210 0549 and Ignition cable 9210 0342**

These parts should be renewed when the insulation is damaged or the connections do not give satisfactory service. If the cable is to be replaced, note that it must be screwed out of the high-tension socket 9210 0501. The assembling of the cable clip is shown in Figs. 118a and 118b.

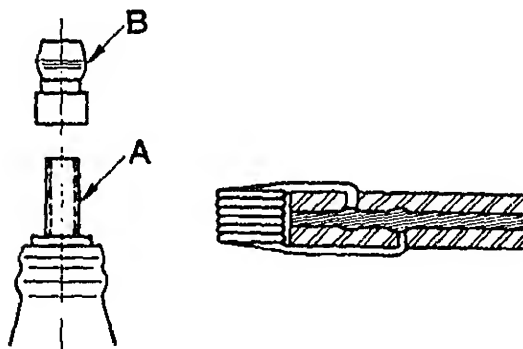
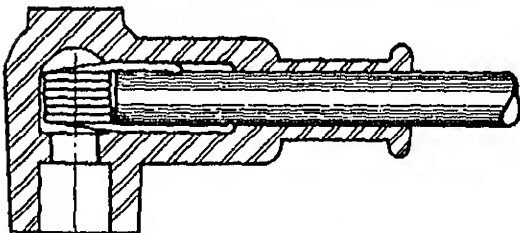


Fig.118a. Fit connecting nut B to the connecting screw A.  
Fit the spring to the Ignition cable as shown in the figure

Fig. 118b Insert the cable with spring into the cable clip until it reaches the position shown in the figure.



## **Spark plug**

Clean the spark plug and see that the insulator is clean and dry to eliminate the risk of leaks. Check that the electrodes and the insulator are free from defects. The gap between the electrodes should be 0.5 mm (0.020 in.). Check the gap with feeler gauge 9201 0325. See Fig. 119. If the electrodes are badly burned, a new spark plug should be fitted.

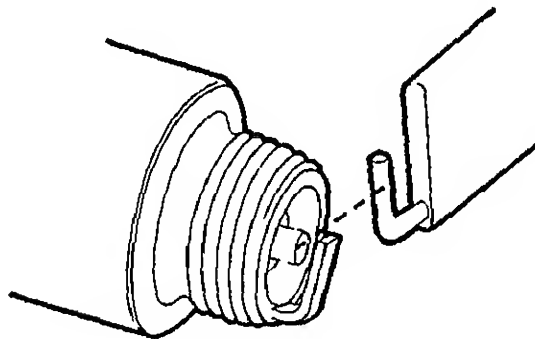
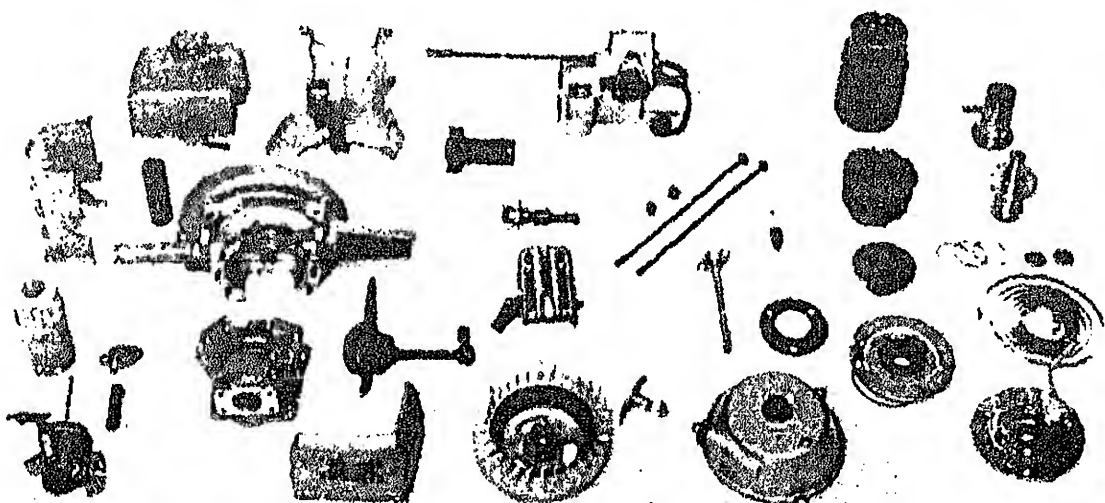


Fig. 119 Measure the gap between the electrodes of the spark plug with feeler gauge 9201 0325. The gap should be 0.5 mm (0.020 in.).

Fig. 120. The main component parts for BBM 47L.



be started in connection with the assembling, all moving parts should be oiled. Check that all screws and nuts are properly tightened.

The following points should be given particular attention when assembling.

- ① See that the marks on the connecting rod and the cap tally.
- ② Fit the motor piston so that the arrow stamped on the top of the piston faces the flywheel side.

③ *Before the crankshaft is fitted, turning fork 9210 0126 must be placed in its position in one of the crankshaft halves.*

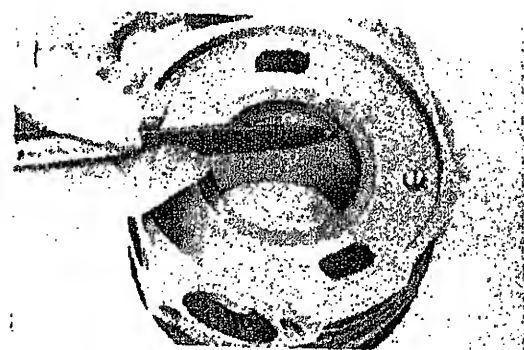
- ④ Before the crankshaft halves are joined together, coat the joint surfaces of the crankcase halves with the sealing compound Permatex 2 or the like.

⑤ *Note that dice 9210 0154-80 (see Fig. 31) should be fitted with the stop edge for the needle cages turned outwards and with the bevelled face turned towards the turning fork. The space housing the dice and the turning fork must not be filled with grease more than up to two-thirds.*

- ⑥ If several machines are overhauled at the same time, check that the numbers on the crankcase halves tally.

- ⑦ See that the sealing rings 9210 0132 in the compressor cylinder are replaced in the same order as they had before being removed and that they are not turned. Check that the rings are correctly placed in their ribs and that they are not jammed but run smoothly in their grooves. See Fig. 121.

Fig. 121. Check that the sealing rings in the compressor cylinder are in their correct positions and that they are not jammed. This can be checked by feeling with a blunt object if the rings run smoothly in their grooves.



should be turned away from the cylinder. See Figs. 18 and 21.

- ⑧ Check that the two guide screws 9210 0181 in the compressor cylinder are properly tightened and that the packing between the compressor cylinder and the motor cylinder as well as between the compressor cylinder and the crankcase are correctly turned.

- ⑨ When fitting the flywheel, be careful not to damage the contact breaker arm. Check that no unattached parts have become stuck to the magnets of the flywheel. Bend the cables so that they do not rub against the flywheel. See Fig. 114.

- ⑩ The gap between the contact breaker points can be checked with the feeler gauge included in the tool box.

The flywheel has three similar holes through which the gap between the contact breaker points can be measured, but only the hole marked "B" permits an adjustment of the gap. The gap should be between 0.3—0.5 mm (0.012—0.020 in.). It should be adjusted to the maximum figure 0.5 mm (0.020 in.). If the gap requires adjustment, loosen slightly the screw 160 1169 for the contact breaker body. Then insert a screw driver in the slot in the contact breaker body and the stator disc. Turning to the left increases and turning to the right decreases the gap. See Fig. 115. When the correct gap has been obtained, tighten screw 160 1169 and check the gap once more.

- ⑪ Fit the striking piston 9210 0437 and the intermediate part 9210 0438 in the cylinder. Secure the gasket 9210 0323 in the lower section with a little oil or grease.
- ⑫ When refitting the lower section, attention should be paid to the following:

Fit the O-ring 9210 0523 on the cylinder.

*Hold the tool chuck with the hand to prevent it from falling out.*

*Turn the torsion shaft to and fro until it is felt that the shaft meshes properly.*

Screw on the nuts of the set bolts but do not tighten them completely.

*By means of the gauge 9201 0147 supplied with the machine the torsion shaft should be aligned square to the crankcase. See Fig. 122.*

The nuts of the set bolts should be tightened alternately to avoid breakage. They should be tightened with a torque of 2.0 kpm (15 ft.lb.). Check the tightening after the test run.

- 15 After the machine has been assembled, check the sparking by earthing the spark plug against the machine and pulling the start wire to see that sparking occurs between electrodes of the spark plug. See Fig. 123.

## Test run

### BBM 47L

The test running comprises measuring of compressor pressure, air blowing pressure, and speed of the machine. The following preliminary steps should be taken:

### BBM 47L

1. For measuring the compressor pressure (the pressure under the striking piston)

Replace plug 686 4101 by socket screw 9201 0399 from which hose 9201 0331 should be connected to pressure gauge 872 6103 ..... Fig. 124

2. For measuring the air blowing pressure

Replace socket screw 9210 0665 by socket screw 9201 0397, from which hose 9201 0331 should be connected to pressure gauge 872 6100 ..... Fig. 125

3. For measuring the speed

Replace nut 9210 0279 by nut 9210 0377 ..... Fig. 126

Fig. 122. By means of the gauge 9201 0147 the torsion shaft should be aligned so that it is located square to the crankcase.

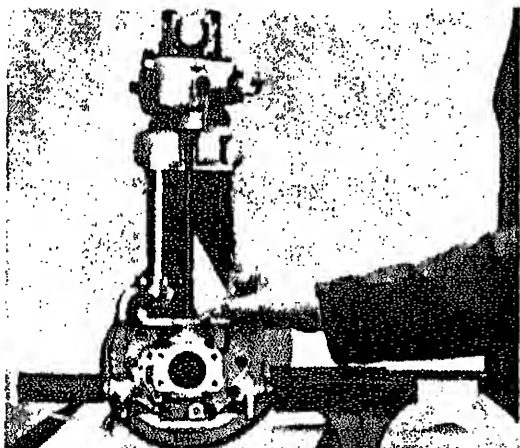


Fig. 123. Checking the sparking by earthing the spark plug against the handle of the machine and pulling the start wire.

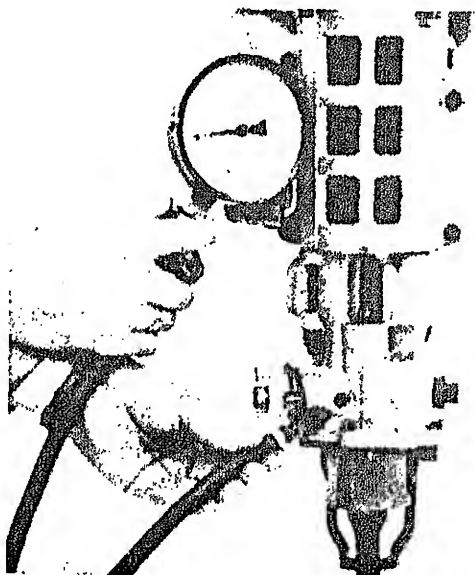
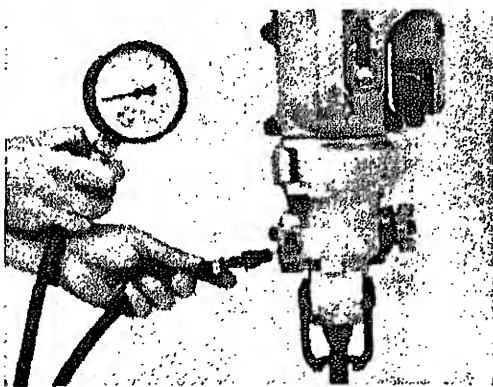


Fig. 124. Connection of hose with pressure gauge for measuring the compressor pressure.

Fig. 125. Connection of hose with pressure gauge for measuring the air blowing pressure.



higher speed than 2500 rpm, this is due to leakage.

The most common reasons for this leakage are:

1. Defective compressor valves.
2. Incorrectly fitted packings, such as the packing 9210 0323 between the lower section and the intermediate part, and the packing 9210 0455 at the attachment for the delivery pipe on the compressor cylinder.
3. O-rings damaged when fitting, such as the O-ring 9210 0523 between cylinder and lower section, and the O-ring 9210 0511 which seals at the attachment for the delivery pipe in the lower section.

If the speed is too high, there is a danger of the speed appropriate for the striking piston being exceeded.

After overhauling, starting difficulties may sometimes occur because air has entered the fuel system or oil has collected on the spark plug. Ignition trouble may occur, even after the character of the spark has been checked, when the ignition coil has attained the correct operating temperature (max. temperature after about 20 minutes). Any possible fractures on the coiling will then become apparent as a result of the heat expansion of the coil, and the machine stops. It will be possible to start the machine again when the temperature has dropped. Contact faults on the condenser and the spark plug will be revealed only after the machine has been started.

Check the tightening of the set bolt nuts after the test run.

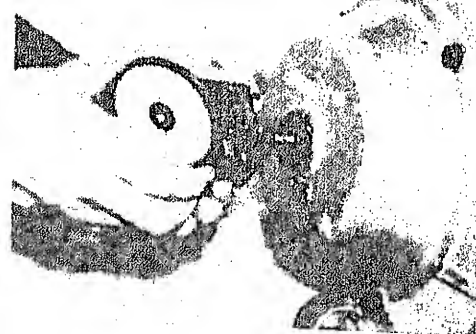


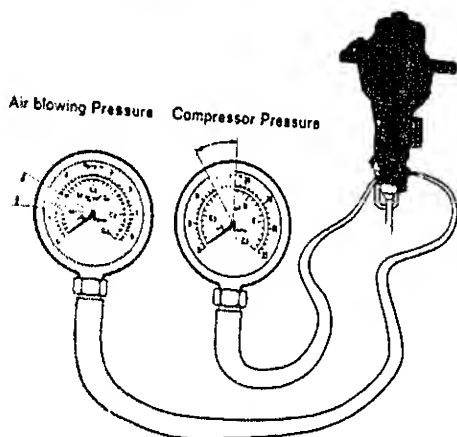
Fig 126 Measuring the speed.

Attach a newly ground drill steel with bit cutting edge width of 0.5 mm (0.020 in.) to the machine and do five minutes hot running, after which the test run follows. See Fig. 129.

For approved test run, the following values should be obtained:

COBRA, type .....		BBM 47L
Compressor pressure ..	kg/cm <sup>2</sup>	0.9—1.3
	psig	12.8—18.5
Air blowing pressure ..	kg/cm <sup>2</sup>	0.09—0.16
	psig	1.3—2.3
Speed .....	rpm	2000—2500

Fig 129. Measuring the air blowing pressure and the compressor pressure.





Part number	Description	and clearances		See page
		mm	in.	
210 0101	Motor cylinder (BBM 47L, BBM 45L only)			
	diameter, max. ....	45.20	1.7795	
	Renewal recommended at ....	45.16	1.7780	
210 0105	Motor piston			
	diameter, min. ....	44.85	1.7657	
	piston ring groove — piston ring, max. clearance ....	0.2	0.008	
210 0109	Connecting rod (BBM 45L/LS, BBM 45SP only)			
	connecting rod bearing — gudgeon pin, max. clearance ....	0.06	0.0024	
	connecting rod bearing — crank web, max. clearance ....	0.07	0.0028	
210 0120	Crank piece (BBM 45L/LS only)			
	diameter of pin holes, max. ....	10.15	0.3996	
210 0121	Bottom plate (BBM 45L/LS only)			
	diameter of hole for torsion shaft, max. ....	14.1	0.555	
210 0120	Turning fork (BBM 47L, BBM 45L/LS only)			
	diameter of journal, min. ....	18.9	0.783	
	turning fork — disc, max. clearance ....	0.2	0.008	
210 0127	Torsion shaft (BBM 45L/LS only)			
	diameters according to Fig. 94, min. ....	14.80 15.90 13.90	0.583 0.626 0.547	
210 0131	Piston rings for striking piston			
	gap, max. ....	0.8	0.032	
	Renewal recommended at ....	0.6	0.024	
210 0132	Sealing rings in compressor cylinder			
	gap, to be adjusted to ....	0.3 — 0.4	0.012 — 0.016	
210 0162	Bushing for torsion shaft (BBM 45L/LS only)			
	inside diameter, max. ....	16.05	0.6319	
210 0153	Bushing for turning fork (BBM 47L, BBM 45L/LS only)			
	bushing — turning fork, max. clearance ....	0.2	0.008	
210 0170	Sleeve for delivery pipe (BBM 45L/LS only)			
	inside diameter, max. ....	12.6	0.496	
210 0173	Latchets (BBM 45L/LS only)			
210 0174				
	wear according to Fig. 103			
210 0175	Latchet bar (BBM 45L/LS only)			
	diameter, min. ....	8.8	0.347	
210 0182	Plug (BBM 45L/LS only)			
	length (unthreaded portion) min. ....	9.5	0.374	
210 0186	Pin for feed (BBM 45L/LS only)			
	diameter, min. ....	9.94	0.3913	
210 0193	Carburettor valve			
	valve opening, max. ....	2.5	0.098	
210 0207	Spring for plug (BBM 45L/LS only)			
	length, min. ....	17.0	0.67	
210 0209	Valve spring for carburettor valve			
	length, min. ....	28.5	1.122	
210 0229	Piston rings for motor piston			
	gap, max. ....	0.8	0.032	
	Renewal recommended at ....	0.6	0.024	

# APPENDIX A

## BASIC ISSUE ITEMS LIST

### Section I. INTRODUCTION

#### 1. Scope

This appendix lists items which accompany Paving Breaker-Drill or are required for installation, operation, or operator's maintenance.

#### 2. General

This Basic Issue Items is divided into the following sections:

**Basic Issue Items—Section II.** This section is a listing of accessories, repair parts, and publications required for operator's maintenance and operation, initially issued, or authorized for the Paving Breaker-Drill.

**Maintenance and Operating Supplies—Section III.** This section is a listing of maintenance and operating supplies required for normal operation.

#### 3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II:

**Source, Maintenance, and Recoverability Codes (SMR), Column 1:**

(1) Source Code indicates the selection status and source for the listed item. Source codes are:

#### Explanation

-----Applied to repair parts which are stocked in or supplied from GSA/DSA Army supply system, and authorized for use at indicated maintenance categories.

-----Applied to repair parts which are not procured or stocked but are to be manufactured at indicated maintenance categories.

A -----Applied to assemblies which are not procured or stocked as such, but made up of two or more units, each of which has individual stock numbers and descriptions, and are procured and stocked and assembled by units at indicated maintenance categories.

X -----Applied to parts and assemblies which are not procured or stocked, the mortality rate of which is normally below that of the applicable end item, and the failure of which should result in retirement of the end item from the supply system.

X1 -----Applied to repair parts which are not procured or stocked, the requirements for which will be supplied by use of the next higher assembly or component.

X2 -----Applied to repair parts which are not stocked. The indicated maintenance category requiring such repair parts is an attempt to obtain them through cannibalization; if not obtainable through cannibalization, such repair parts must be requisitioned with supporting justification through normal supply channels.

C -----Applied to repair parts authorized for local procurements. If not obtainable through local procurement, such repair parts must be requisitioned through normal supply channels with a supporting statement of nonavailability from local procurement.

G -----Applied to major assemblies that are procured with PEMA (Procurement Element Missile Army) funds for issue only to be used as exchange assemblies at DSU and GSU level or returned to depot supply level.

**Note.** Source code is not shown on common hardware items known to be readily available in Army supply channels and through local procurement.

# APPENDIX A

## BASIC ISSUE ITEMS LIST

### Section I. INTRODUCTION

#### I. Scope

This appendix lists items which accompany Paving Breaker-Drill or are required for installation, operation, or operator's maintenance.

#### II. General

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**B. Maintenance and Operating Supplies—Section III.** This section is a listing of maintenance and operating supplies required for normal operation.

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The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II:

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C -----Applied to repair parts authorized for local procurements. If not obtainable through local procurement, such repair parts may be requisitioned through normal supply channels with a supporting statement of nonavailability from local procurement.

G -----Applied to major assemblies that are procured with PEMA (Procurement Element Missile Army) funds for issue only to be used as exchange assemblies at DSU and GSU level or returned to depot supply level.

*Note.* Source code is not shown on common hardware items known to be readily available in Army supply channels and through local procurement.

- (2) Maintenance Code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
.....	Operator/crew

- (3) Recoverability Code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	Explanation
.....	Applied to repair parts and assemblies which are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
.....	Applied to high dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts are normally repaired or overhauled at depot maintenance activities.
.....	Applied to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value reusable casings and castings.

*b. Federal Stock Number, Column 2.* This column indicates the Federal Stock Number for the item.

*c. Description, Column 3.* This column indicates the Federal item name and any additional description required. A five-digit manufacturer's or other service code is shown in parentheses followed by the manufacturer's part number. Repair parts quantities included in kits, sets, and assemblies that differ from the actual quantity used in the specific item, are listed in parentheses following the repair part name.

*d. Unit of Issue, Column 4.* This column indicates the unit used as a basis of issue, e.g., ea, pr, ft, yd, etc.

*e. Quantity Incorporated in Unit Pack, Column 5.* This column indicates the actual

*f. Quantity Incorporated in Unit, Column 6.* This column indicates the quantity of the item used in the equipment.

*g. Quantity Furnished With Equipment, Column 7.* This column indicates the quantity of an item furnished with the equipment in excess of the quantity incorporated in the unit.

*h. Quantity Authorized, Column 8.* This column indicates the quantity of an item authorized the operator/crew to have on hand or to obtain as required. As required items are indicated with an asterisk.

#### A-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies—Section III

*a. Item, Column 1.* This column contains numerical sequence item numbers assigned to each component application to facilitate reference.

*b. Component Application, Column 2.* This column identifies the component application of each maintenance or operating supply item.

*c. Federal Stock Number, Column 3.* This column indicates the Federal Stock Number for the item and will be used for requisitioning purposes.

*d. Description, Column 4.* This column indicates the item and a brief description.

*e. Quantity Required for Initial Operation, Column 5.* This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

*f. Quantity Required for 8 Hours Operation, Column 6.* This column indicates the estimated quantities required for an average eight hours of operation.

*g. Notes, Column 7.* This column indicates informative notes keyed to data appearing in a preceding column.

#### A-5. Federal Supply Code

main, and ov code		Federal stock No.	Description	Unit of issue	Qty inc in unit pack	Qty inc in unit	Qty Furn with equip	A
(B) M	(C) R							
			Group 31—Basic Issue Items Manufacturer Installed					
			3100 Basic Issue Items Manufacturer or Depot Installed					
0	----	7520-559-9618	Case, Maintenance and Operational Manuals; Cotton duck, water repellent.	EA	-----	-----	1	
0	----	-----	Hose, Exhaust (14388) 92100707 -----	EA	-----	-----	1	
0	----	-----	Pack, Frame (14388) 92100724 -----	EA	-----	-----	1	
	----	-----	Box, Transport (14388) 92100700 -----	EA	-----	-----	1	
0	----	-----	Wedge (14388) 92000144 -----	EA	-----	-----	1	
0	----	-----	Drill Steel (14388) 7140434 -----	EA	-----	-----	1	
0	----	-----	Padlock (14388) 92100526 -----	EA	-----	-----	1	
0	----	-----	Oil Measure (14388) 92010148 -----	EA	-----	-----	1	
0	----	-----	Grease Tube (14388) 92100848 -----	EA	-----	-----	1	
0	----	-----	Tool Roll Assembly -----	EA	-----	-----	1	
			Consist of the Following Items					
0	----	-----	Screwdriver (14388) 9027519 -----	EA	-----	-----	1	
0	----	-----	Screwdriver (14388) 9027618 -----	EA	-----	-----	1	
0	----	-----	Pliers, Flat (14388) 92010372 -----	EA	-----	-----	1	
0	----	-----	Pliers (14388) 9030102 -----	EA	-----	-----	1	
0	----	-----	Wrench, Spanner (14388) 9020408 -----	EA	-----	-----	1	
0	----	-----	Wrench, Open End (14388) 9020415 -----	EA	-----	-----	1	
0	----	-----	Wrench, Open End (14388) 9020417 -----	EA	-----	-----	1	
0	----	-----	Wrench, Open End (14388) 9021082 -----	EA	-----	-----	1	
0	----	-----	Wrench, Open End (14388) 90210887 -----	EA	-----	-----	1	
0	----	-----	Wrench, Socket (14388) 92010388 -----	EA	-----	-----	1	
0	----	-----	Wrench, Socket (14388) 92010389 -----	EA	-----	-----	1	
0	----	-----	File, Breaker Point (14388) 92010324 -----	EA	-----	-----	1	
0	----	-----	Gauge, Feeler (14388) 92010325 -----	EA	-----	-----	1	
0	----	-----	Gauge, Angle (14388) 92010147 -----	EA	-----	-----	1	
0	----	-----	Template, Grinding (14388) 7951827 -----	EA	-----	-----	1	
0	----	-----	Holder W/Needle (14388) 16000294 -----	EA	-----	-----	1	
0	----	-----	Gauge, Chuck Wear (14388) 30010088 -----	EA	-----	-----	1	

### Section III. MAINTENANCE AND OPERATING SUPPLIES

Component application	Federal stock number	Description	Quantity required for initial operation	Quantity required for 8 hours operation	Notes
FUEL TANK	9130-160-1818	Gasoline, Bulk, Regular Grade, MIL-G-3056.			(1) See C9100-IL for additional data and requisition procedures.
FUEL TANK	9150-265-9483	Oil, Lubricating, MIL- L-2104, OE-30, 1 qt. can.	1 qt.		(2) Mix 1 part lub- ricating oil to parts gasoline.
ROTATION JOINT	9150-257-5361	Grease, Aircraft, MIL- G-7711, GB, 1 lb. can.	1 lb.		(3) Grease rotation joint at least o- a week.

# APPENDIX B

## MAINTENANCE ALLOCATION

### Section I. INTRODUCTION

#### -1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

#### 2. Explanation of Columns in Section II

a. *Function Group Number. Column 1.* The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1, Functional Grouping Codes) are listed on the AC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. *Component Assembly Nomenclature. Column 2.* This column contains a brief description of the components of each functional group.

c. *Maintenance Functions. Column 3.* This column lists the various maintenance functions (through K) and indicates the lowest main-

tenance category authorized to perform functions. The symbol designations for various maintenance categories are as follows:

C—Operator or crew

O—Organization maintenance

F—Direct support maintenance

H—General support maintenance

D—Depot maintenance

The maintenance functions are defined as follows:

A—INSPECT. To determine serviceability of an item by comparing physical, mechanical, electrical characteristics with established standards.

B—TEST. To verify serviceability and to test electrical or mechanical equipment by use of test equipment.

C—SERVICE. To clean, to preserve, to change oil, to paint, and to add fuel, lubricants, cooling agents, and air.

D—ADJUST. To rectify to the extent necessary to bring into proper operating range.

E—ALIGN. To adjust specified variable elements of an item to bring to optimum performance.

F—CALIBRATE. To determine the corrections to be made in readings of instrument or test equipment used for precise measurement.

sons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

**G—INSTALL.** To set up for use in an operational environment such as an emplacement, site, or vehicle.

**H—REPLACE.** To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

**I—REPAIR.** To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

**J—OVERHAUL.** To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

**K—REBUILD.** To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original man-

ent reassembly of the

*d. Tools and Equipment. Column 4.* This column is provided for referencing by code the special tools and test equipment, (Section II) required to perform the maintenance function (Section II).

*e. Remarks. Column 5.* This column is provided for referencing by code the remarks (Section IV) pertinent to the maintenance functions.

### **B-3. Explanation of Columns in Section II.**

*a. Reference Code.* This column contains a number and a letter separated by a dash. The number references the T&TE required for the specific maintenance function the item is used with. The letter is representative of the columns A through K on the MAC.

*b. Maintenance Category.* This column indicates the lowest level of maintenance authorized to use the special tool or test equipment.

*c. Nomenclature.* This column lists the name or identification of the tool or test equipment.

*d. Tool Number.* This column lists the manufacturer's code and part number, or the Stock Number of tools and test equipment.

### **B-4. Explanation of Columns in Section III.**

*a. Reference Code.* This column contains two letters separated by a dash, both of which are references to Section II. The first letter references column 5 and the second letter references a maintenance function column A through K.

*b. Remarks.* This column lists information pertinent to the maintenance function performed, as indicated on the MAC, Section II.

Functional Group No.	Component assembly nomenclature	Maintenance functions											Note refer	
		A	B	C	D	E	F	G	H	I	J	K	L	
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild	Tools and Equipment	
1	Engine													
100	Engine Assembly													
	Engine, Gasoline -----	O/C	F	O/C	--	--	--	--	--	F	H	--	1,28	
101	Crankcase, Block, Cylinder Head													
	Crankcase													
	Crankcase -----								F	--	--	--	8,9,10	
102	Crankshaft													
	Crankshaft -----								F	--	--	--		
	Bearing, Seals -----								F	--	--	--	6,7	
103	Flywheel													
	Flywheel -----							O	F	--	--	--	2	
104	Piston, Connecting Rod													
	Piston and Rod Assembly -----								F	--	--	--	3,4,5	
105	Valves													
	Plate Assembly, Reed -----								F	--	--	--		
107	Engine Starting System													
	Starter, Recoil Assembly -----								O	O	F	--		
8	Fuel System													
301	Carburetor													
	Carburetor -----				O	--	--	--	--	O	F	--	11,12,13, 14,15	
304	Air Cleaner													
	Air Cleaner -----								O	O	--	--		
306	Tank, Lines Filling													
	Tank Fuel -----								O	O	--	--		
312	Accelerator, Throttle or Choke Controls													
	Throttle Assembly -----								O	O	--	--		
4	Exhaust System													
401	Muffler								O	--	--	--		
5	Cooling System													
	Cowling Deflector													
	Deflector -----								O	--	--	--		
6	Electrical System													
605	Ignition Component													
	Magneto -----				O	--	--	--	--	O	F	--		
1	Basic Issue Item													
	Manufacturer Installed													
100	Basic Issue Items													
	Manufacturer or Depot Installed.													
	Accessory Items								O	--	--	--		
0	Machine Tools													
006	Power Hammers		F	--	--	--	--	--	F	F	--	--	16 thru 27	
007	Power Grinders			O	--	--	--	--	--	F	--	--		